DISSERTATION ON

OUTCOMES OF TREATMENT FOR FEMORAL HEAD FRACTURES WITH HIP DISLOCATION

SUBMITTED TO

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In Partial fulfillment of the regulations

for the award of the degree of

M.S. (ORTHOPAEDIC SURGERY)

BRANCH II

MADRAS MEDICAL COLLEGE

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CERTIFICATE

This is to certify that this dissertation titled **"Outcomes of Treatment for Femoral Head Fractures with Hip Dislocation"** is a bonafide record of work done by **Dr.SENTHIL.S,** during the period of his postgraduate study from July 2013 to September 2015 under guidance and supervision in the **INSTITUTE OF ORTHOPAEDICS AND TRAUMATOLOGY,** Madras Medical College and Rajiv Gandhi Government General Hospital, Chennai- 600003, in partial fulfillment of the requirement for **M.S.ORTHOPAEDIC SURGERY** degree examination of The Tamilnadu Dr. M.G.R. Medical University to be held in April 2016.

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INTRODUCTION

Femoral head fractures following posterior dislocation of hip are relatively uncommon, but it can occur with association of other severe injuries. Femoral head fractures are seen in polytraumatized patients, especially after motor vehicle accidents.

The injury mechanism in most cases are compression along the shaft of femur, with force vector acting longitudinally to the hip joint, common injury being dashboard injuries[1]. Less common causes are fall from height, industrial accidents, adventure sports injuries and pedestrians struck by motor vehicles. Open injuries at knee joint may be associated, as are the pelvic and spine injuries.

Reported incidence of fracture dislocation of hip ranged from 4% to 17% in different studies[2,3,4]. The femoral head dislocates when the traumatic force exceeds the hip joint stability biomechanically.

The position of the leg during the injury determines the magnitude of dislocation and its association of osseous lesions of femoral head or the acetabulum[4].

Early reduction and appropriate treatment is the priority to prevent fracture related complications. Any delay in reduction can lead on to the development of osteonecrosis.

Many treatment modalities were evaluated, however there was no firm conclusions regarding optimal treatment of these injuries. Moreover these fracture patterns have poor functional outcome. Most literatures to date support the correlation between anatomic reduction and long term good results.

Outcomes are determined by many factors. Some are modifiable and others were not. The non modifiable factors include:1) cartilage damage at the time of injury, 2) injury to the vascularity of the femoral head which is precarious.

Modifiable factors are: 1) Time to reduction of dislocation from injury, 2) accuracy of fracture fragment fixation and 3) maintaining stability till fracture healing.

Epstein et al[5] "suggested that all traumatic dislocations of the hip must be treated as surgical emergencies, indicated that reduction within 24 hours gives better results than late reduction".

The morbid surgical approaches to the hip also causes poor outcome. Swiontkowski et al[6]"compared anterior versus posterior approach and found that anterior approach caused less blood loss, shorter operation time and better visualization but resulted in more heterotopic ossification".

Stockenhuber et al[7] "showed that there is little or no interference with the blood supply of the femoral head via this approach". On the other hand, the posterior approach is associated with additional damage to the posterior circulation.

The goals for femoral head fractures treatment are achieving an anatomical reduction, restoring and maintain stability and preventing complications. Regardless of a variety of treatment options, long term complications affect the fracture healing and rehabilitation of femoral head fracture, leading to a relatively poor functional outcome.

The common complications include avascular necrosis, arthritis and heterotropic ossification[5,8,9,10]. Management requires sound knowledge about the anatomy, current treatment options, potential complication and methods to tackle them.

AIM OF THE STUDY

To assess the clinical and functional outcome of treatment for femoral head fractures in thirteen patients managed in our Institute of Orthopaedics and Traumatology, Madras Medical College and Rajiv Gandhi Government General Hospital over a period of 5 years from July 2010 to July 2015 retrospectively and prospectively.

APPLIED ANATOMY

The hip joint is a polyaxial synovial joint. It is of ball-and-socket (spheroidal, cotyloid) variety which is inherently stable. The femoral head articulates with the acetabulum and is incompletely covered, the fibrous labrum adds 10% to the coverage of the femoral head, thereby increasing the acetabular depth. The capsule of the hip joint is strong which extends from the acetabular rim anteriorly to the intertrochanteric line and posteriorly to the neck of femur.

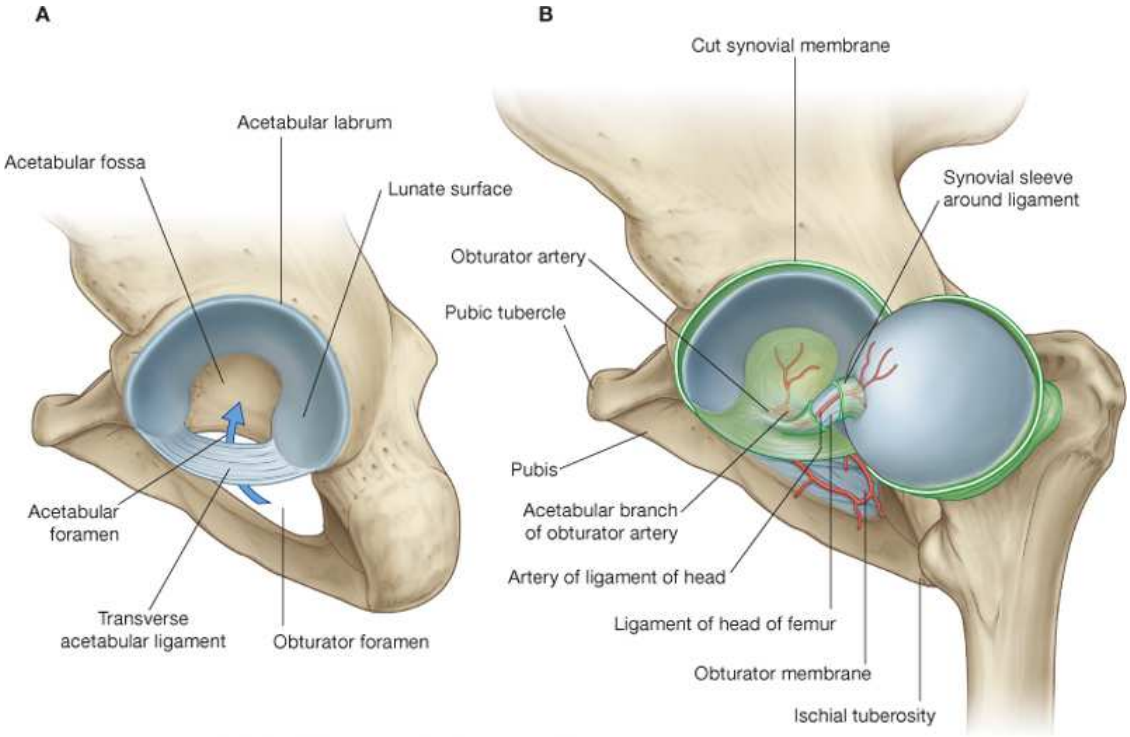


Fig: 1 Articulating surfaces of hip joint A) Acetabular surface B) Femoral head

The capsule is thicker anterosuperiorly, where maximal stress occurs, particularly in standing; posteroinferiorly it is thin and loosely attached. It has two types of fibres, inner circular and outer longitudinal.

The capsule is supported by the capsular thickenings called ligaments, anteriorly the iliofemoral or Y ligament, posteriorly ischiofemoral and inferiorly pubofemoral ligaments. All these structures add to the stability of the joint requiring a significant force to dislocate it.

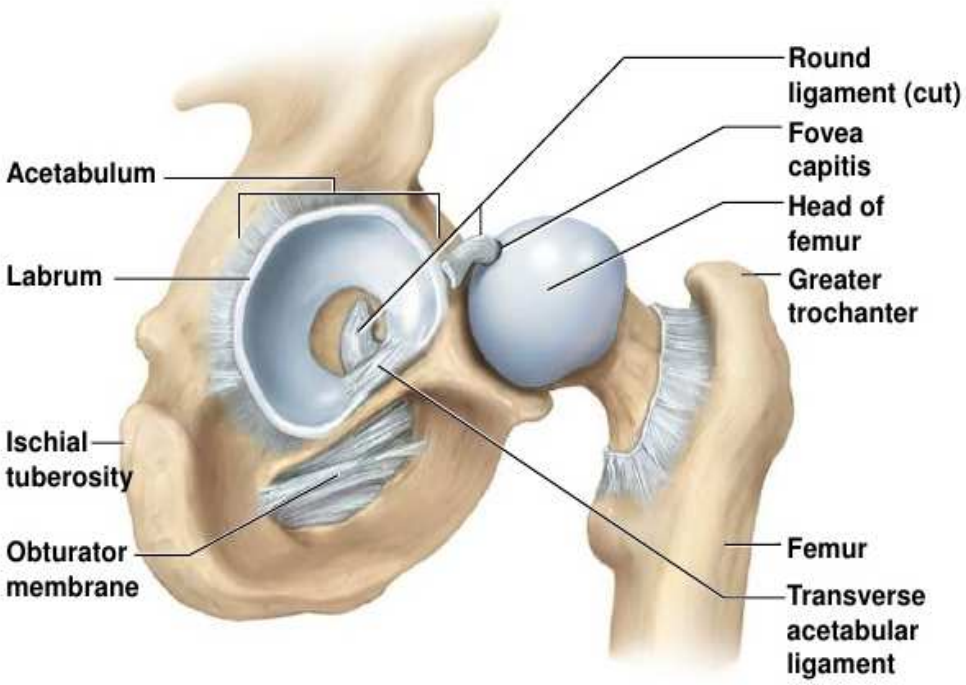


Fig: 2 Hip joint with ligamentum teres cut showing the fibrous labrum

Factors maintaining stability

The fibrous labrum

The thick capsule reinforced by the ligaments.

Ligaments- Iliofemoral,ischiofemoral,pubofemoral and to some extent by the transverse ligament and the ligament of the head.

A 'vacuum effect' in acetabulum.

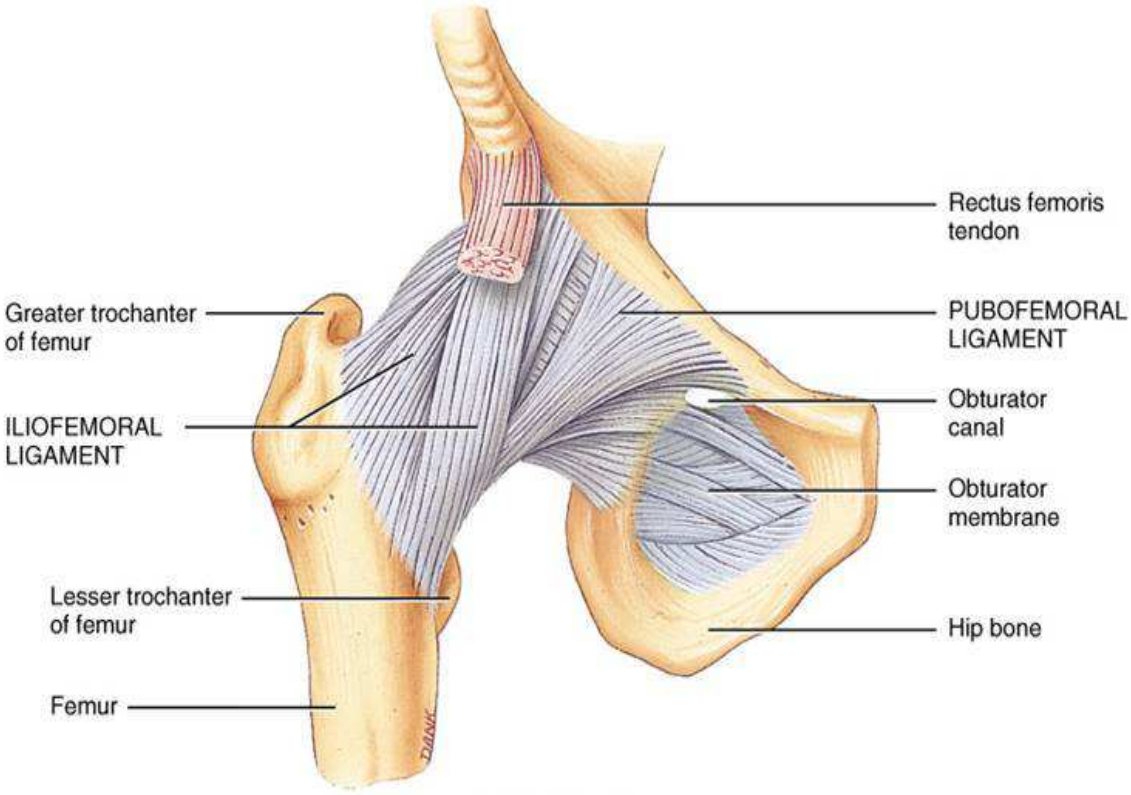


Fig: 3 Hip anterior view showing iliofemoral or Y ligament and pubofemoral ligament

The articular surfaces are reciprocally curved but neither coextensive nor completely congruent. The close-packed position is in full extension, with slight abduction and medial rotation.

Movements of the hip joint can be categorized as flexion-extension, adduction - abduction, medial and lateral rotation, and circumduction.

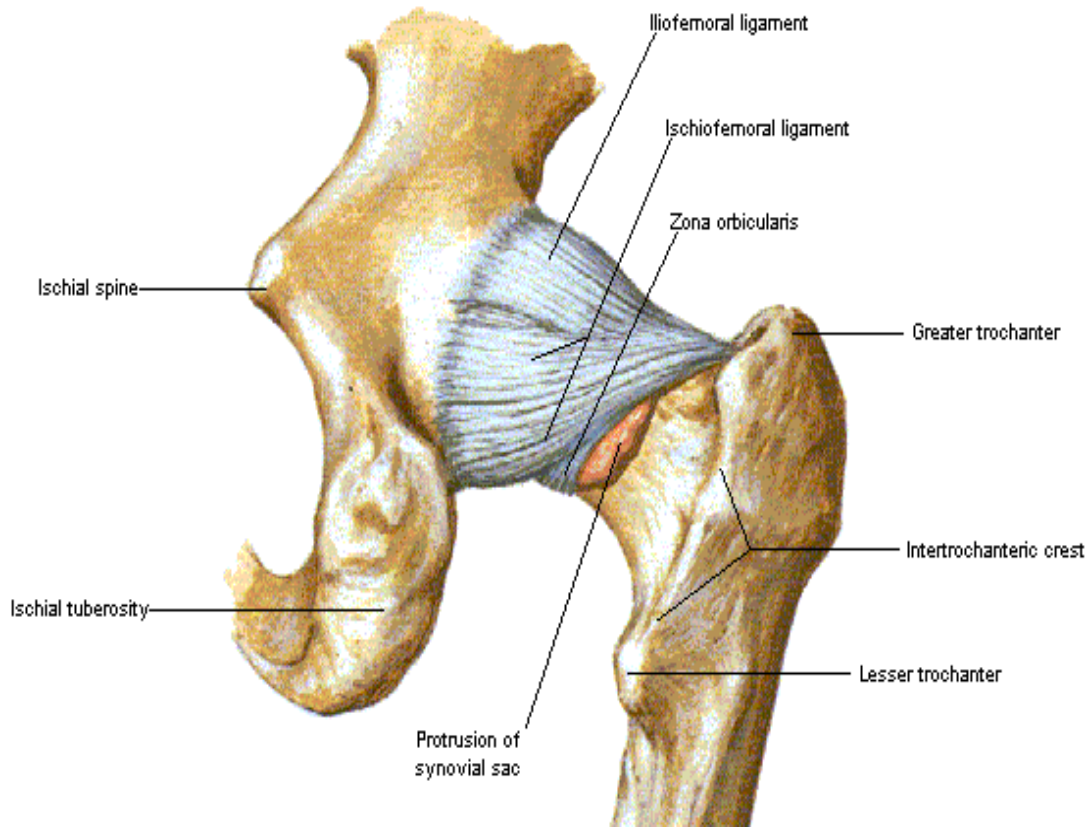


Fig: 4 Hip posterior view showing ischiofemoral ligament

Neurovascular anatomy

Three nerves of the lower limb (Sciatic,femoral and obturator) pass in proximity to hip. The sciatic nerve runs posteriorly to the joint and is at risk in posterior dislocations. The obturator nerve runs through the superolateral obturator foramen which is accompanied by the obturator artery. The femoral nerve lies medial to the psoas in the same sheath and can be injured with anterior dislocation.

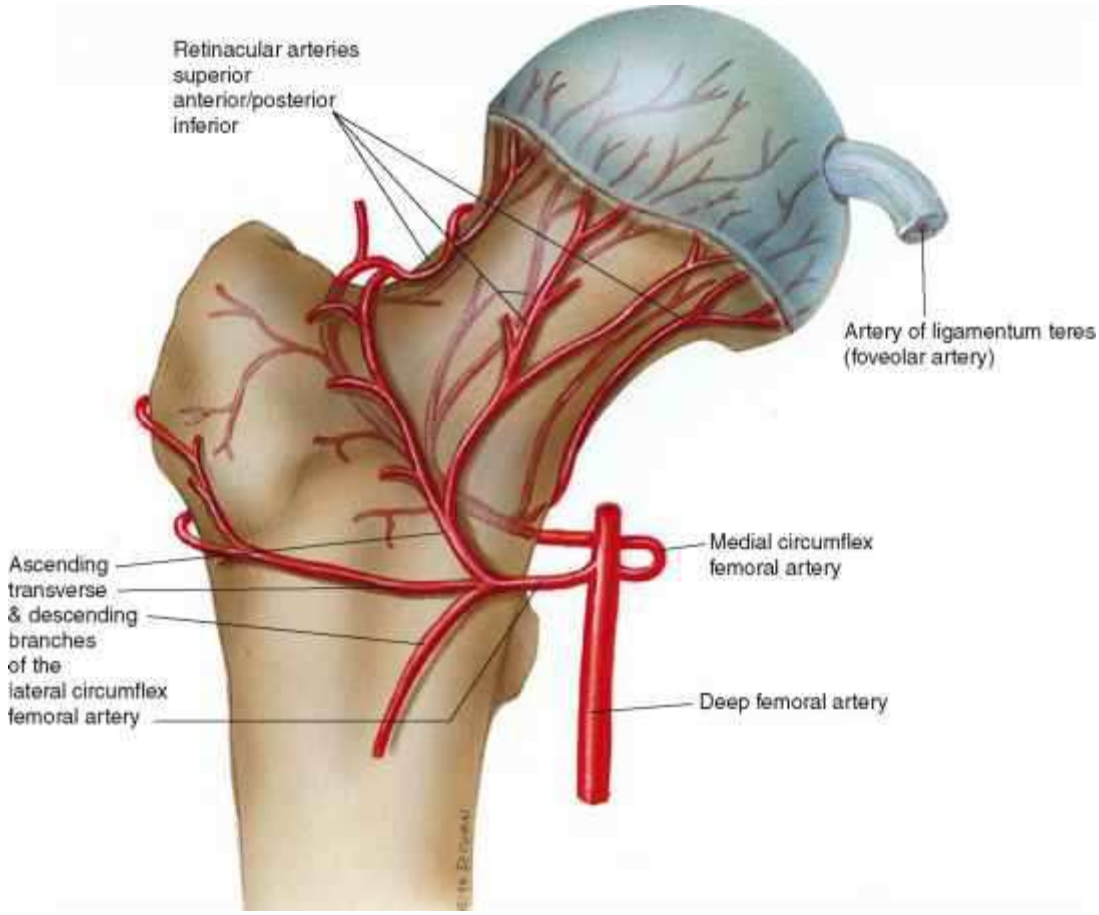


Fig: 5 Blood supply of hip joint

Sources of blood supply:

1) capsular vessel,

2) intramedullary vessels, and

3) a contribution from the ligamentum teres.

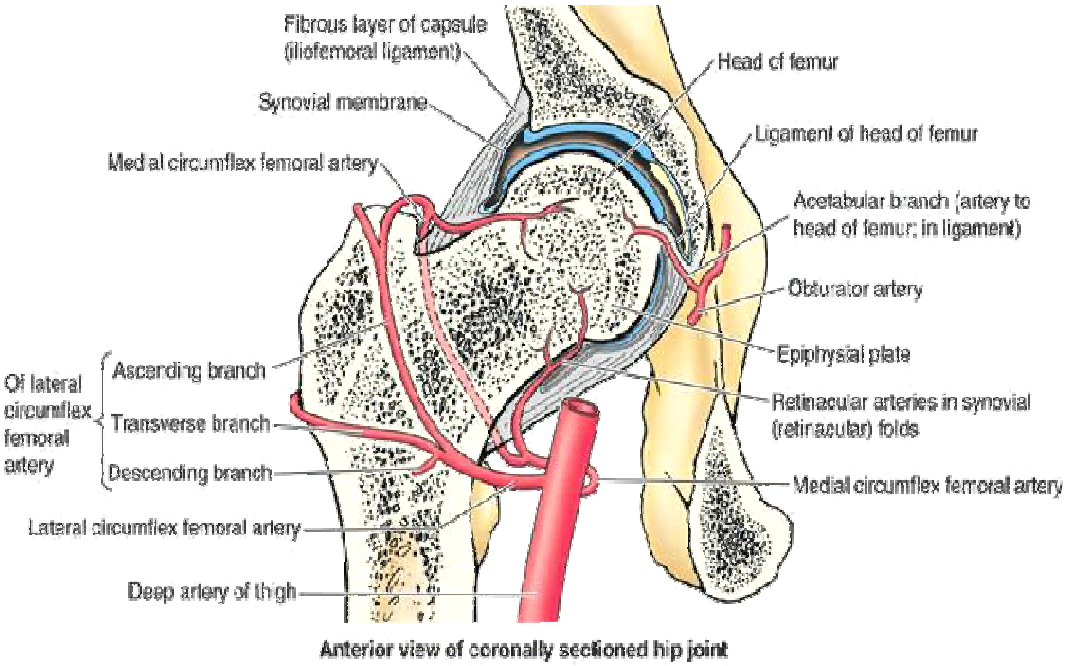


Fig: 6 Coronal Section Through Hip Joint

1) Capsular vessels arise from the medial and lateral circumflex femoral arteries branches of the profunda femoris forming an extracapsular circular anastomosis at the base of the femoral neck.

They ascend within the capsule and are referred to as retinacular vessels. There are four main groups (anterior, medial, lateral, and

posterior), of which the lateral group is the largest contributor to femoral head blood supply[11] .

The retinacular vessels arising from the deep branch of the medial femoral circumflex artery supply the main weight-bearing area of the femoral head. There is a second ring anastomosis termed subsynovial intra-articular ring.

2) The artery of the ligamentum teres is a branch of the obturator or medial femoral circumflex artery.

3) Some additional blood supply in the adult reaches the head via the medullary bone in the neck.

Biomechanics and pathoanatomy

Hip being a ball-and-socket joint, allows more degrees of freedom and resultant mobility. Stability of the hip is due to its role as the fulcrum for large muscles to act, which forces the femoral head into the acetabulum, taking advantage of its depth.

The capsule allows greater freedom of motion in multiple directions. The horseshoe shaped acetabular articular cartilage is thickest laterally and peripherally, the loading pattern primarily being peripheral.

The femoral head forms approximately two thirds of a sphere, its position within the acetabulum is affected by the normal anteversion of the femoral neck on the shaft of 12 degrees and by the neck-shaft angle, which averages 125 degrees[12] .

The forces acting across the joint are body weight, abductor muscle force and joint reaction force.

The joint reaction force on the hip is greater than the body weight in swing phase, which can be an important factor during rehabilitation of patients.

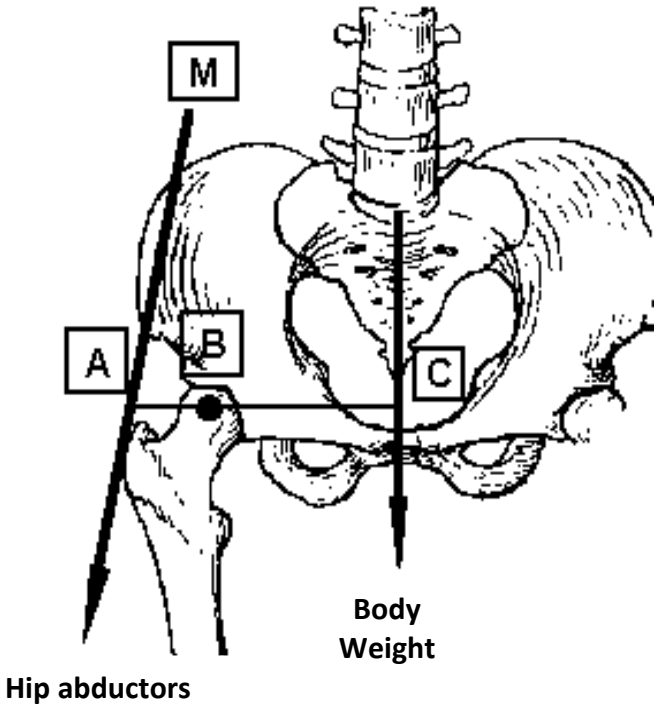


Fig: 7 Biomechanics of hip

The ligamentum teres and at least a portion of the capsule must be disrupted, for the hip to dislocate, this happens by a rotational force or by direct pressure.

In posterior dislocations, the degree of flexion at the time of the injury determines whether the capsule is torn either directly posteriorly or inferoposteriorly.

In anterior dislocations, the psoas acts as the fulcrum of the hip, and the capsule is disrupted anteriorly and inferiorly.

MECHANISM OF INJURY

Most hip dislocations occur due to motor vehicle accidents which result in high-energy trauma. Restrained drivers are at a lower risk for hip dislocation than unrestrained drivers. Other mechanisms include fall from height, pedestrians struck by motor vehicles, industrial accidents, and adventure sport injuries.

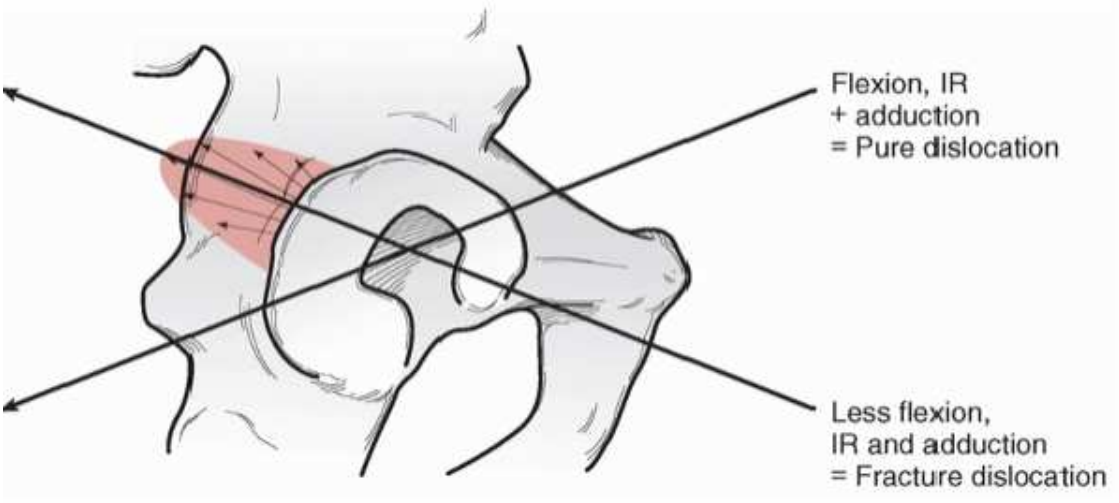


Fig:No- 8 Relationship between hip position and injury pattern

Hip position	Injury pattern
Flexion, adduction, IR	Pure posterior dislocation
Partial flexion, less adduction, IR	Posterior fracture dislocation
Hyperabduction, extension, ER	Anterior dislocation
ER, external rotation of the hip; IR, internal rotation of the hip.”	

The factors which determine whether a fracture-dislocation or pure dislocation occurs are the position of the hip during impact, the force vector applied, and the individual's anatomy.

"Upadhyay[16] and colleagues studied the femoral anteversion in patients with hip dislocations and fracture-dislocations. They observed a decreased anteversion acts to place the head in a more posterior position as does internal rotation, both tending to produce a pure dislocation. Conversely, greater anteversion and less internal rotation led to fracture-dislocation".

Associated Fractures in hip dislocation

- Femoral neck fractures
- Acetabular fractures
- Femoral head fractures
- Pelvic ring fractures
- Femoral shaft fractures
- Knee ligament injuries
- Spine injuries

Classification systems

Thompson and Epstein classified the posterior hip dislocation into five types with fifth type describing its association with femoral head fractures, which are further subdivided by pipkin.

"Thompson and Epstein Classification[13]

1) Type I Pure hip dislocation without fracture

2) Type II Posterior dislocation with a large single fracture of the posterior acetabular rim

3) Type III Posterior dislocation with a comminuted fracture of the rim of acetabulum

4) Type IV Posterior dislocation with fracture of the acetabular rim and floor

5) Type V Posterior dislocation with femoral head fractures and other injuries."

Pipkin in 1957 was first to propose the classification of these fracture dislocations, which gave his name to this fracture-dislocations. Classification is based on the femur head fracture with respect to the fovea and additional fracture on the femoral neck or acetabulum. Other

classification systems include brumback and orthopaedic trauma association classification.

Pipkin classification[14]

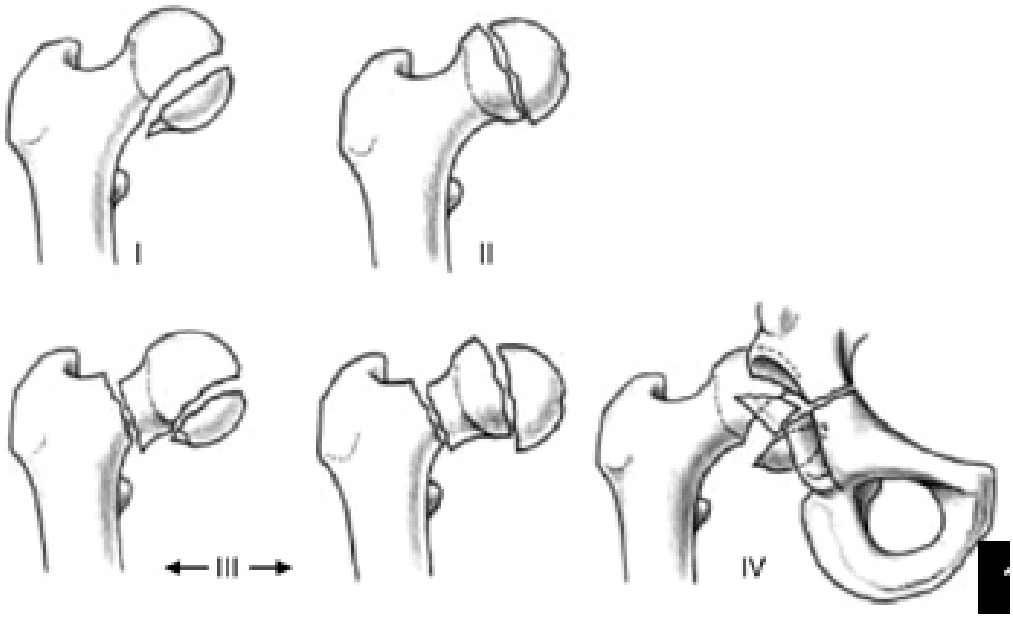


Fig: 9 Pipkin classification

Type I is with the fracture below the fovea outside of the weight bearing portion.

Type II fractures above fovea involve the more cranial, weight bearing parts.

Type III is any fracture of the head in combination with a femoral neck fracture.

Type IV is any fracture of the head in combination with acetabular fracture."

"Classification of Femoral Head Fractures (Brumback) [17]

Type	Description
Type 1	Posterior hip dislocation with fracture of the femoral head involving the inferomedial portion of the femoral head
Type 1A	With minimum or no fracture of the acetabular rim and staple hip joint after reduction
Type 1B	With significant acetabular rim and stable joint after reconstruction
Type 2	Posterior hip dislocation with fracture of the femoral head involving the supermedial portion of the femoral head
Type 2A	With minimum or no fracture of the acetabular rim and stable joint after reduction

Type 2B With significant acetabular fracture and hip joint instability

Type 3 Dislocation of the hip (unspecified direction) with femoral neck fracture

Type 3A Without fracture of the femoral head

Type 3B With fracture of the femoral head

Type 4 Anterior dislocation of the femoral head

Type 4A Indentation type: depression of the superolateral surface of the femoral head

Type 4B Transchondral type; osteocartilaginous shear fracture of the weight-bearing surface of the femoral head

Type 5 Central fracture-dislocation of the hip with femoral head fracture.”

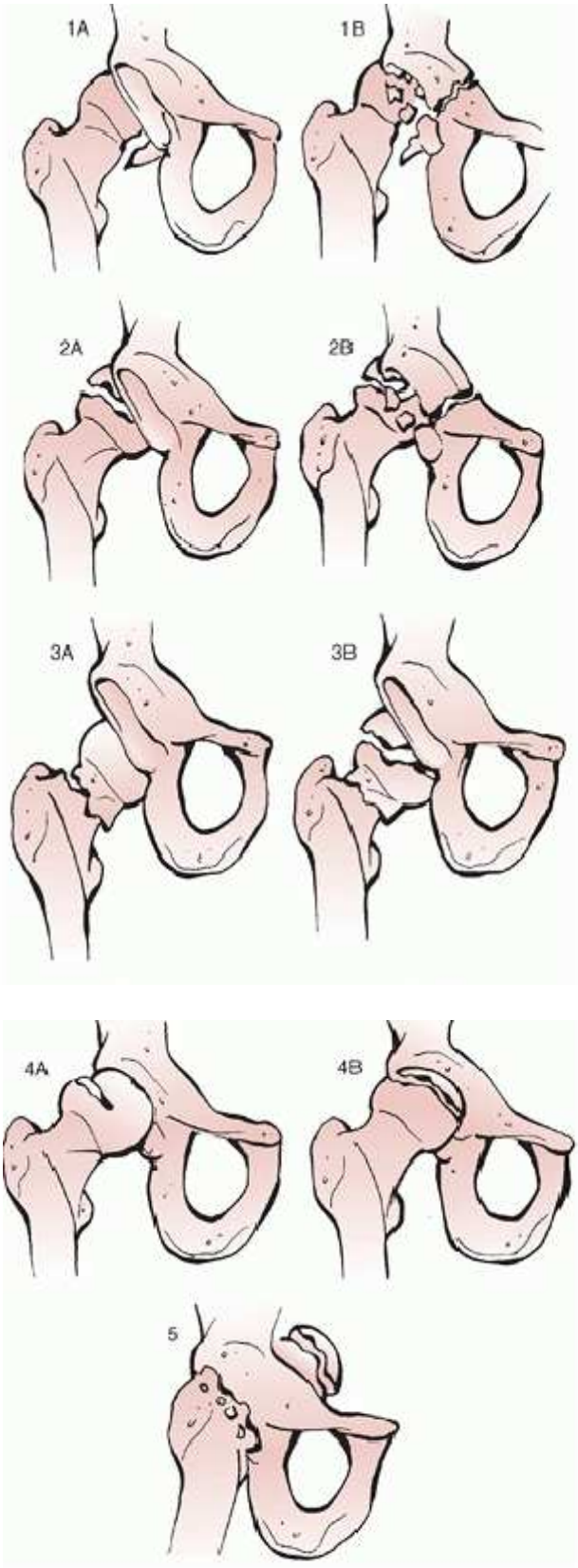


Fig: 10 Brumback classification of femoral head fractures

Radiographic Evaluation

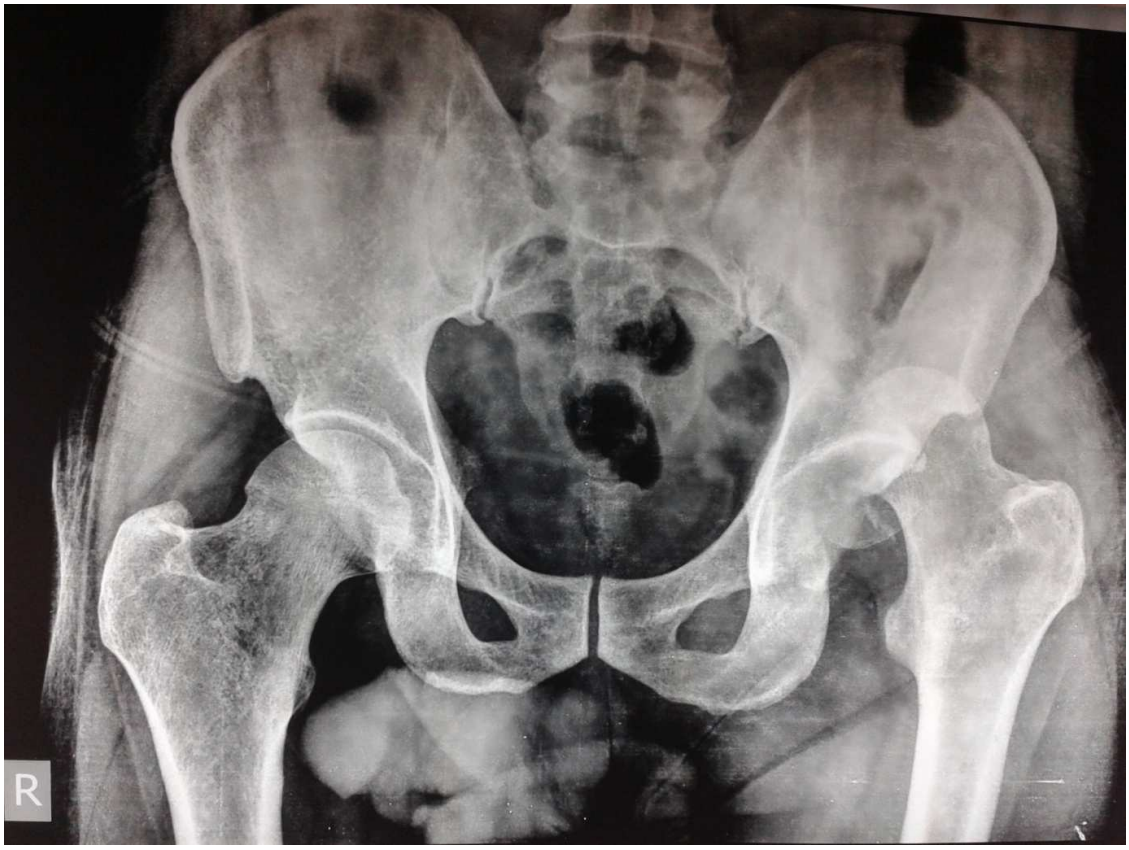


Fig: 11 AP view of pelvis with both hips showing left posterior dislocation with fracture head of femur

Initial evaluation of patients with suspected hip dislocation requires an anteroposterior view of the pelvis. The majority of hip dislocations can be diagnosed on this view. The addition of a cross-table lateral view confirms an anterior or posterior dislocation.

Radiographic features in posterior hip dislocations are:

1. Femoral head lateral and superior to the acetabulum

2. Femur is internally rotated and adducted

3. Head of femur may appear smaller with or without fracture

4. Posterior rim of acetabulum may have fractures.

Following reduction of the hip dislocation, repeat the anteroposterior radiograph of the pelvis and lateral view of the hip, looking for evidence of incongruent reduction of the femoral head.

If there is a question of an acetabular fracture, 45° oblique views of the pelvis (Judet views) are indicated[22] .

CT is helpful for evaluation of residual incongruence between the two, evaluation of acetabular fractures identifying femoral head fractures, and identification of retained osteochondral fragments within the hip joint.

3D reconstructed images helps further in assessing the true extent and size of the fracture fragments.

Fig: 12 CT scan with 3D reconstruction showing fracture head of femur with posterior dislocation

Reduction of the dislocation

Once the diagnosis of dislocation of the femoral head is established, perform the hip reduction as soon as possible, ideally with complete muscular relaxation under a regional or general anesthesia to decrease the risk of chondral injury to cartilage of the femoral head.

In addition, it is possible to examine the hip while the patient is still under anesthesia to assess the stability following reduction. Such assessment may aid in deciding postoperative care. Reduction of the hip can also be done in the emergency room setting with appropriate intravenous sedation.

Delay in reduction of hip dislocations has shown increased incidence of avascular necrosis. Yue et al[18] "reported that posterior dislocation of the hip causes kinking of the external iliac artery over the pelvic brim, impeding flow through the medial femoral circumflex artery in cadaver specimens. Reduction of the femoral head should be performed early, ideally within 6 hours of injury, to minimize the risk of avascular necrosis".

Carefully evaluate the initial radiographs to look for associated fractures of the femoral head and femoral neck. When these associated fractures are present, the reduction should be accomplished under general

anesthesia, preferably with image intensifier control to ensure that significant displacement of the femoral neck fracture does not occur. In selected cases, fixation of the femoral neck fracture before reduction may be necessary.

Several methods of reduction of a dislocated hip have been described that involve traction in line with the existing deformity. For posterior dislocations, the Allis and Bigelow maneuvers are performed with the patient supine; an assistant provides countertraction to the pelvic ring.

The Stimson maneuver, performed with the patient prone, eliminates the need for countertraction on the pelvis. It is of historical importance. Other injuries and the need for sedation may contraindicate the prone position.

“East Baltimore Lift” utilizes several assistants to reduce the dislocation to make the reduction less difficult to the surgeon.

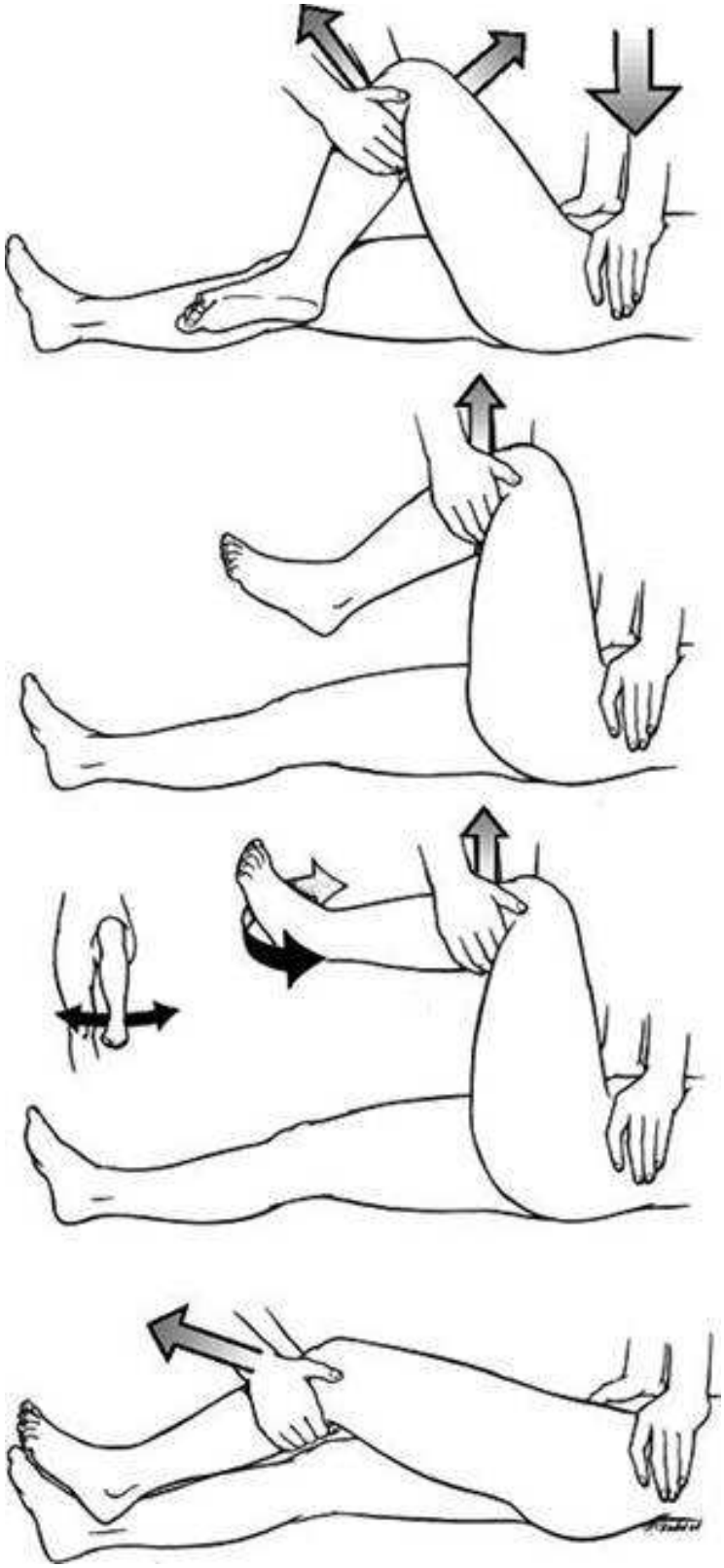


Fig: 13 Alli's manauver of reducing a poterior hip dislocation

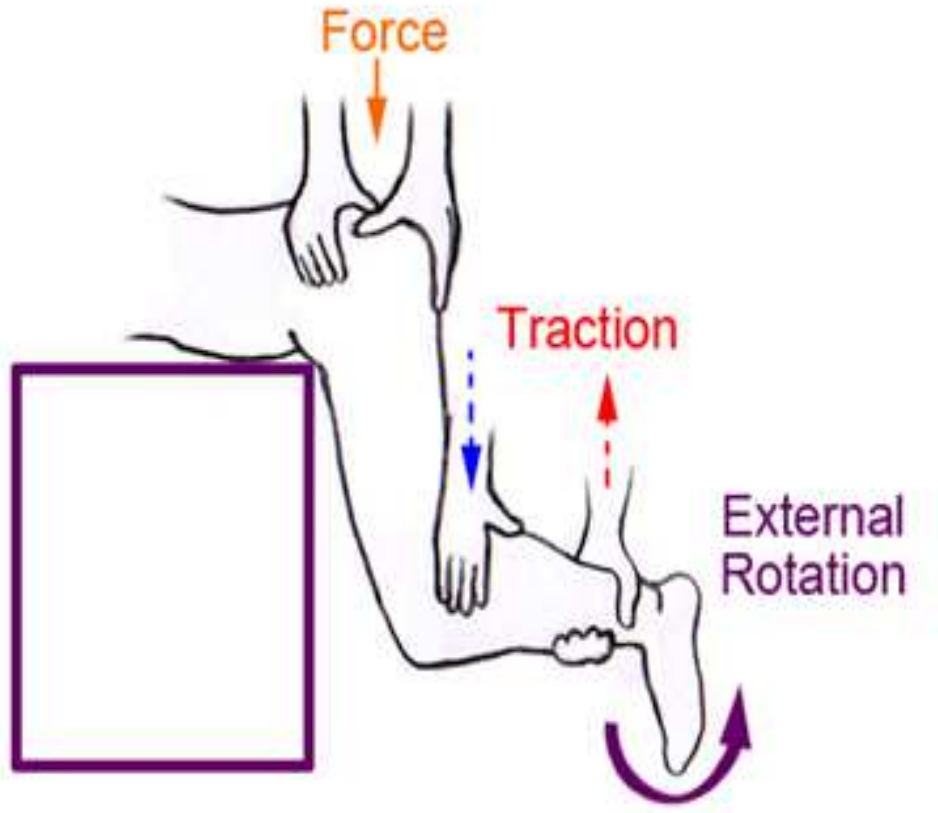


Fig: 14 Stimson gravity method of reduction of posterior hip dislocation

Reduction of posterior dislocation requires traction on the involved hip in a flexed and adducted position. Gentle rotational oscillation of the hip may assist in easing it over the acetabular rim into the socket.

The same maneuver can be used in the lateral decubitus position. Use of a sheet around the pelvis for countertraction provides the surgeon added mechanical advantage.

Once the femoral head has been relocated, the hip is easily abducted and extended accompanied by restoration of limb lengths and external rotation of the hip. In rare instances, the dislocation may be irreducible and requires open reduction through a posterior approach.

Following relocation of the hip, obtain an anteroposterior radiograph of the pelvis should be obtained and looked for incongruous reduction, as well as for fractures of the femoral head and femoral neck, and retained osteochondral fragments.

Obtain a cross-table lateral view of the hip if there is a question about the adequacy of the reduction or of a femoral neck fracture. Persistent incongruence of hip joint with retained osteochondral fragments requires open reduction and removal of the intraarticular debris.

Routine use of CT following hip dislocation is controversial[23] . CT is indicated, however, when the surgeon suspects the presence of a significant retained osteochondral fragment or other foreign body within the hip joint.

When these osteochondral fragments are present, anteroposterior and Judet views of the hip, CT, or both are indicated to assess the femoral head for a congruent reduction[24].

Fig: 15 AP view of hip showing (a) Posterior dislocation of hip joint. (b) Postreduction X-ray shows incongruent reduction: a break in Shenton's line and increase in medial joint space. (c) CT scan showed a incongruent reduction due to a large osteochondral fragment from the femoral head. (d) Post excision of the fragment with congruent hip joint

There is no need for surgical intervention as long as a congruent reduction between the femoral head and acetabulum is present. Perform neurovascular examination immediately after reduction.

Postreduction Care

Epstein reported a series of hip dislocations in which skeletal traction was used following reduction of the femoral head . More recent series have demonstrated similar results without postreduction skeletal traction.

Several authors have speculated that postreduction traction would provide the benefit of decompressing the injured hyaline cartilage while the torn capsule heals. This observation, however, has not been borne out in clinical results.

After reducing the femoral head, examine the hip for stability by gently flexing the hip from 0° to 90° with the hip in neutral rotation. Those patients who have a stable hip to 90° of hip flexion must avoid excessive flexion, adduction, and internal rotation of the hip and can be permitted to walk with crutches with limited weight bearing for 4 to 7 days after reduction.

Weight bearing can be gradually increased after that point. These precautions should be continued for at least 6 weeks after dislocation for healing of the soft tissues to take place.

If examination of the hip dislocation demonstrates instability between 45° and 90° of flexion, protect against dislocation with an orthosis. Use either a knee mobilizer or hip abduction brace for 6 weeks and allow the patient to walk using crutches.

If the hip is unstable at 45° or less of flexion, we recommend skeletal traction for approximately 3 weeks postoperatively, followed by bracing or crutches.

Hip dislocations associated with fractures of the acetabulum require treatment of the acetabular fracture. Hip dislocations associated with femoral neck fractures are a rare occurrence. Treatment of these injuries requires careful reduction of the hip under image intensification control.

Make every attempt to ensure that the femoral neck is not displaced during reduction. If there is any question regarding displacement of the femoral neck during the attempt at reduction, fix the femoral neck before performing open or closed reduction of the femoral head dislocation.

Place a Schantz pin from the lateral cortex up into the femoral head, attached to a T-handle to reduce the shear forces across the femoral neck and aid the reduction. Hip dislocations with a displaced femoral

neck fracture are an absolute indication for open reduction of the fracture of neck of femur and femoral head dislocation.

Implants

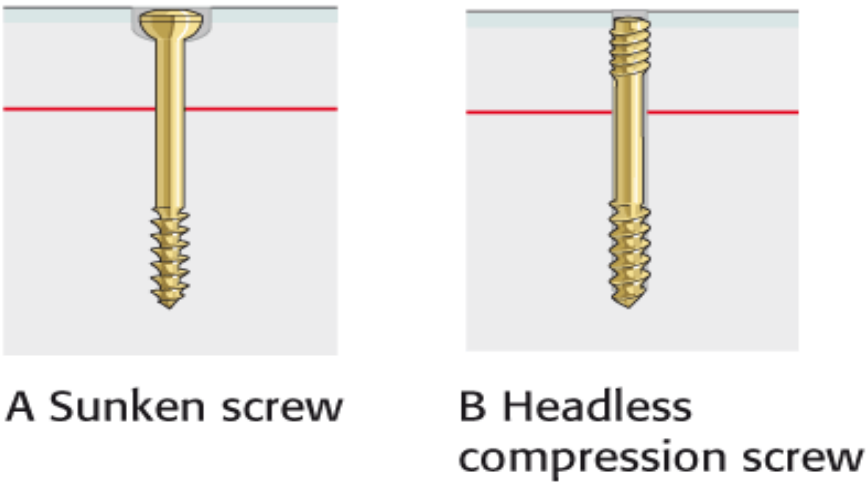


Fig: 16 Screws used in articular surfaces

Herbert screws

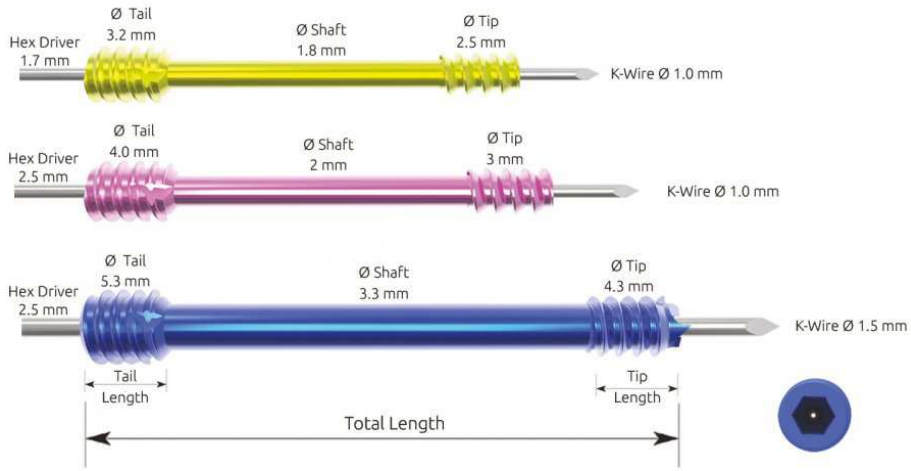


Fig: 17 Herbert screws

A Herbert screw[25] has differential pitch used to compress small fractures fragments. One end has cancellous threads while the other has

larger diameter cortical screw threads. Because of its differential pitch each turn of the screw causes the distal end to travel farther into bone than the proximal end, compressing the fracture.

Cancellous screws with countersunk

A 2mm cancellous screws can be countersinked for fixation of articular surfaces.

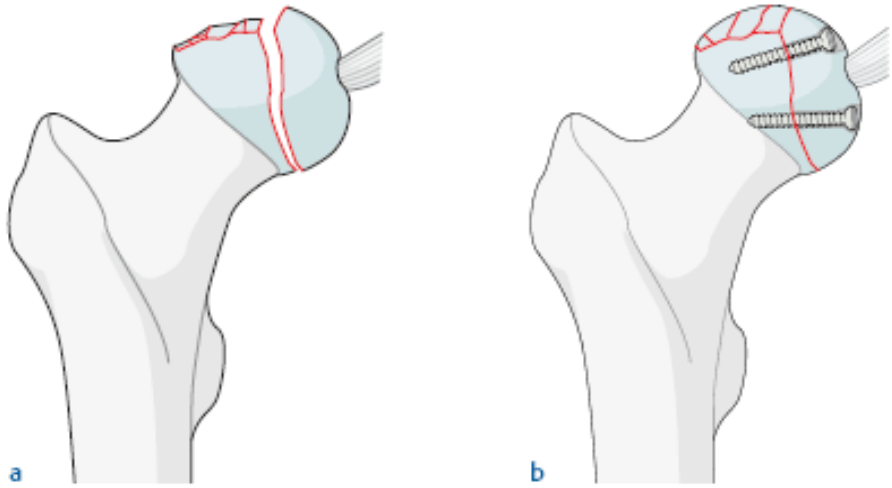


Fig: 18 Cancellous screws in articular surface fixation

Replacement prosthesis

Uncemented total hip replacement

Components were 1) Acetabular shell

2) Polyethylene insert

3)Femoral head

4) Femoral stem

Approaches to hip

Hip can be approached in many ways. The commonly described are

Anterior approaches

1) Smith-Petersen
2) Somerville

Anterolateral approach

1) Smith –Petersen

Lateral approaches

1) Watson-Jones
2) Harris
3) McFarland and Osborne
4) Hardinge
5) Hay modification of McLauchlan

Posterolateral approach

1) Gibson

Posrerior approaches

1) Osborne
2) Moore

Medial approach

1) Ludloff and Ferguson , Hoffenfield and deBoer's modification

REVIEW OF LITERATURE

In 1869 Birkett described the femoral head fractures.

In 1951, Thompson and Epstein[13] gave the classification for posterior hip dislocation before the advent of CT scan. They recommened open reduction for all cases as they believed that all dislocations may contain osteochondral fragment.

In 1953, “Trueta and Harrison reported that there is little or no blood supply to femoral epiphysis from the lateral circumflex femoral artery.”

In 1957, Pipkin suggested classification of femoral head fractures with posterior hip dislocation that is still in use today gave the fracture its name [14].

In 1958, “Keely and Lipscomb reported that the occurance rate of femoral head fracture is two per millions per year[15].”

In 1970’s Epstein recommended excision of fragments in all cases. “In 1985, Epstein et al[5] suggested that all traumatic dislocations of the hip must be treated as surgical emergencies and reduction within 24 hours gives better results than late reduction”.

In 1985, “Upadhyay[16] and colleagues studied the femoral anteversion in patients with hip dislocations and fracture-dislocations. They observed a decrease in femoral anteversion and even femoral retroversion in patients who sustained fracture-dislocations compared to normal population”.

In 1987,Brumback et al[17] gave unified descriptive classification that can be used for both anterior and posterior dislocations and can be used for anterior or posterior dislocations.

In 1992,“Swiontkowski et al[6]. compared anterior versus posterior approach. They found that anterior approach caused less blood loss, shorter duration and better visualization but more heterotopic ossification.”

In 1994, “Stockenhuber et a[7]. showed that there is little or no interference with the blood supply of the femoral head via the anterior approach.

In 1996, Yue et al[18] “reported that posterior dislocation of the hip causes kinking of the external iliac artery over the pelvic brim, impeding flow through the medial femoral circumflex artery in cadaver specimens”.

“In 2001, Ganz and collegues[19] based on their cadaveric studies proposed the safe surgical dislocation method, they found that medial circumflex femoral’s deep branch was protected by intact obturator internus muscle.

In 2001”McMurtry and Quaile[20] showed that the joint should be relocated within 6 hours; failure to do so increases the risk of avascular necrosis of the femoral head.

In 2007, “ Henle et al[21] suggested, if the fracture gap within the joint showed a displacement of >2 mm, operative treatment was indicated to improve reduction.”

MATERIALS AND METHODS

We reviewed thirteen patients who were admitted to our emergency department for femoral head fracture with posterior hip dislocation between July 2010 to September 2015. Clinical data including Xray pelvis AP view, computerized tomography (CT) were done.

Inclusion criteria

Age >18 years.

Pipkin types I, II, III & IV

Exclusion criteria

Age <18 years.

Open fractures.

Fractures with neurovascular compromise.

Patients with medical comorbidities contradicting surgery**.**

There were 13 patients of which 11 were males (84.61%) and 2 were females (15.38%). They were in the age group of 19-53 years with the mean age of 36 years; seven patients (53.84%) had additional injuries.

We treated our patients by 1) the conservative method, 2) excision of fragment, 3) fixation with Herbert screws and 4) replacement with prosthesis.

The treatment given were evaluated by the following parameters

1. Radiographic assessment
2. Functional assessment of post- operative fixation using scores
3. Evaluation of treatment related complications

Patients were evaluated according to the

Type of fracture (Pipkin & Brumback)

Time of injury to reduction and surgery,

Methods of treatment

Association of other injuries and

Complications.

Patients were also evaluated by radiographs for outcomes like rate of AVN of femoral head, arthritis and heterotopic ossification. They were clinically evaluated using Harris hip score and Merle d'aubigne and postel score[18]. Heterotopic ossification was determined by the Brooker classification.

"Brooker classification [26] - Radiographic appearance of AP pelvis

Class I - Isolated islands of bone

Class II - Bone spurs with a gap of at least 1 cm between opposing bone surfaces

Class III - Near complete bone bridging (gap < 1 cm)

Class IV - Apparent ankylosis"

Reduction of dislocation

We performed closed reduction with the patient in the supine position using the Alli's method of traction and countertraction. With the general anaesthesia and patient in supine position on a table, one assistant stabilized the pelvis, then surgeon flexed the knee and the hip to relax the hamstrings.

Steady longitudinal traction in line with the long axis of femur was then applied with the extremity in internal rotation and adduction. While maintaining the applied traction the leg was gently rotated, allowing the reduction, which is confirmed by the reduction clunk.

After reduction the limb was placed on skeletal traction until surgery. Post reduction CT scan was taken to assess the reduction and associated fractures in femoral head, femoral neck and acetabulum.

In one patient after closed reduction it was stable and the fracture fragment was found satisfactorily reduced. We treated that patient conservatively in traction for six weeks and then mobilised gradually. Other twelve patients underwent surgery as either the reduction was unstable or the associated fractures necessitated surgical intervention.

Operative technique

1) Surgical dislocation of the hip and internal fixation with Herbert screws

We adopted safe surgical dislocation of the hip, originally described by "Ganz et al [19] which involves an anterior dislocation of the hip from a posterior approach with a trochanteric flip osteotomy, based on the protection of the deep branch of the medial femoral circumflex artery by obturator internus muscle[27]."

In the lateral decubitus position, we used Gibson posterolateral approach with posterior retraction of gluteus maximus in eight patients for internal fixation.

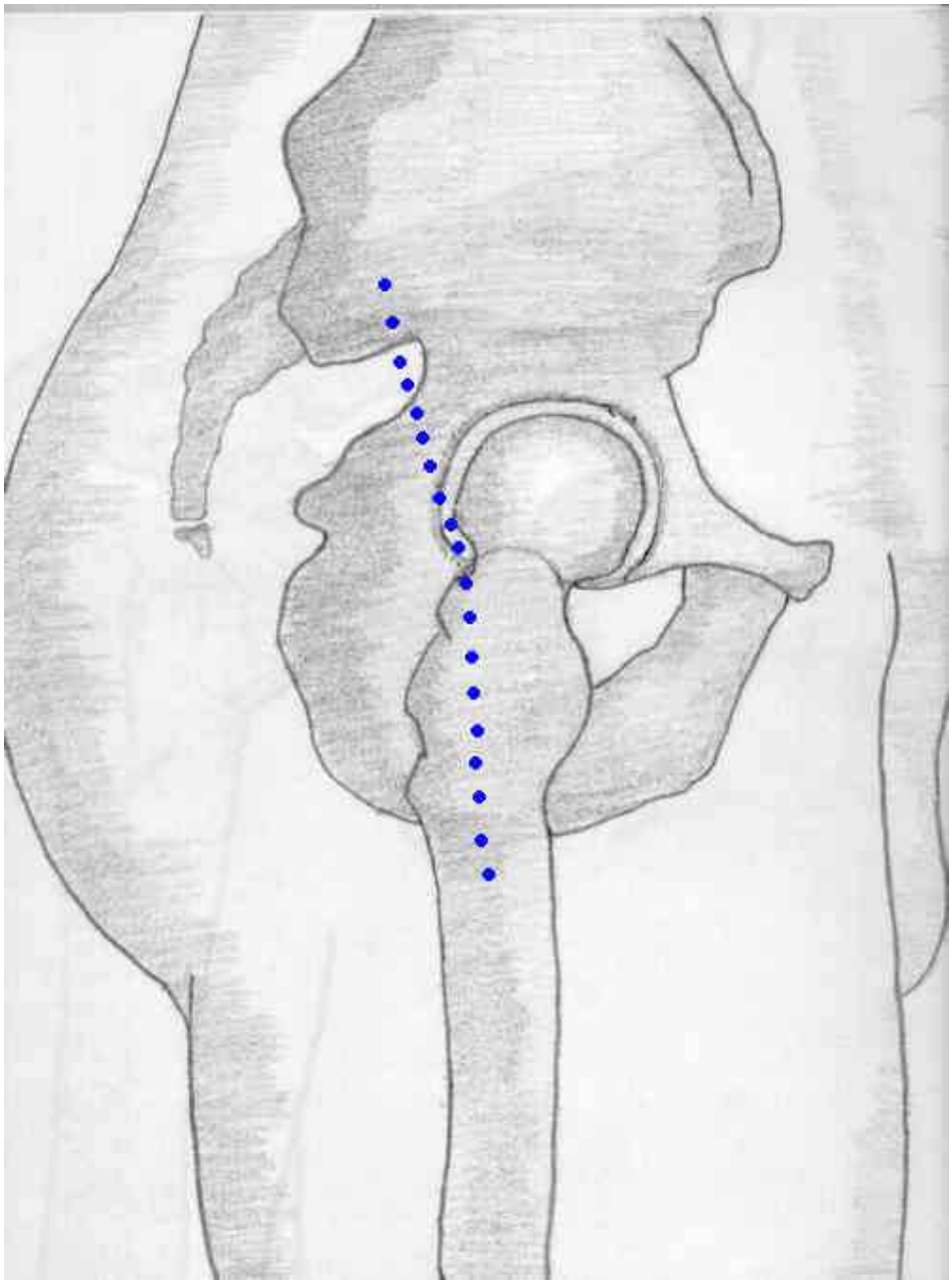


Fig : 19 Gibson approach skin incision.

The skin incision was made 6 to 8 cm anterior to PSIS and just below iliac crest to anterior edge of greater trochanter and extended distally along shaft of femur.

The iliotibial band was cut and from distal to proximal. The leg is then internally rotated and abducted, the posterior border of gluteus medius identified. Proximally, this split is carried slightly posterior to the interval between the tensor and the gluteus maximus (Gibson interval), in line with the direction of the gluteus maximus fibers.

An incision is made from the posterosuperior edge of the greater trochanter extending distally to the posterior border of the ridge of vastus lateralis.

A flat trochanteric osteotomy of about 1.5cm thickness was done using oscillating saw extending from the posterosuperior edge of the greater trochanter distally to the posterior border of the vastus lateralis ridge, leaving the posterior most fibres of gluteus medius remaining in the trochanter.

The osteotomy along with its attached tendons was mobilized anteriorly and the capsule is exposed, a Z-shaped incision was made on it and the leg is flexed and externally rotated to dislocate the hip anteriorly.

The ligamentum teres is then cut leg was positioned in 90 degrees of flexion, slight adduction by lowering the knee, and axial pressure was given by an assistant allowed the 360° access to the femoral head in addition to the acetabulum and acetabular labrum. The femoral head

fragment was either anatomically reduced and fixed or excised and the hip joint is then reduced by distal manual traction,internal rotation, and extension of the lower extremity.

The capsulotomy is closed, and the greater trochanter is secured using two 3.5- or 4.5-mm cortical screws directed at the lesser trochanter. The wound closed in layers with suction drain.

In eight cases we reduced the fractured fragment and provisional k-wires were fixed, upon which the Herbert screws was inserted and sunk. Throughout the procedure the blood supply to the head of femur was assessed by the bleeding from 2 mm drill hole made in the head.

In fixation cases one patient had an associated undisplaced femoral neck fracture which was fixed with cancellous screw.

In all eight cases we found the bleeding after completing the fixation, thus ruling out the iatrogenic loss of blood supply to the femur head.

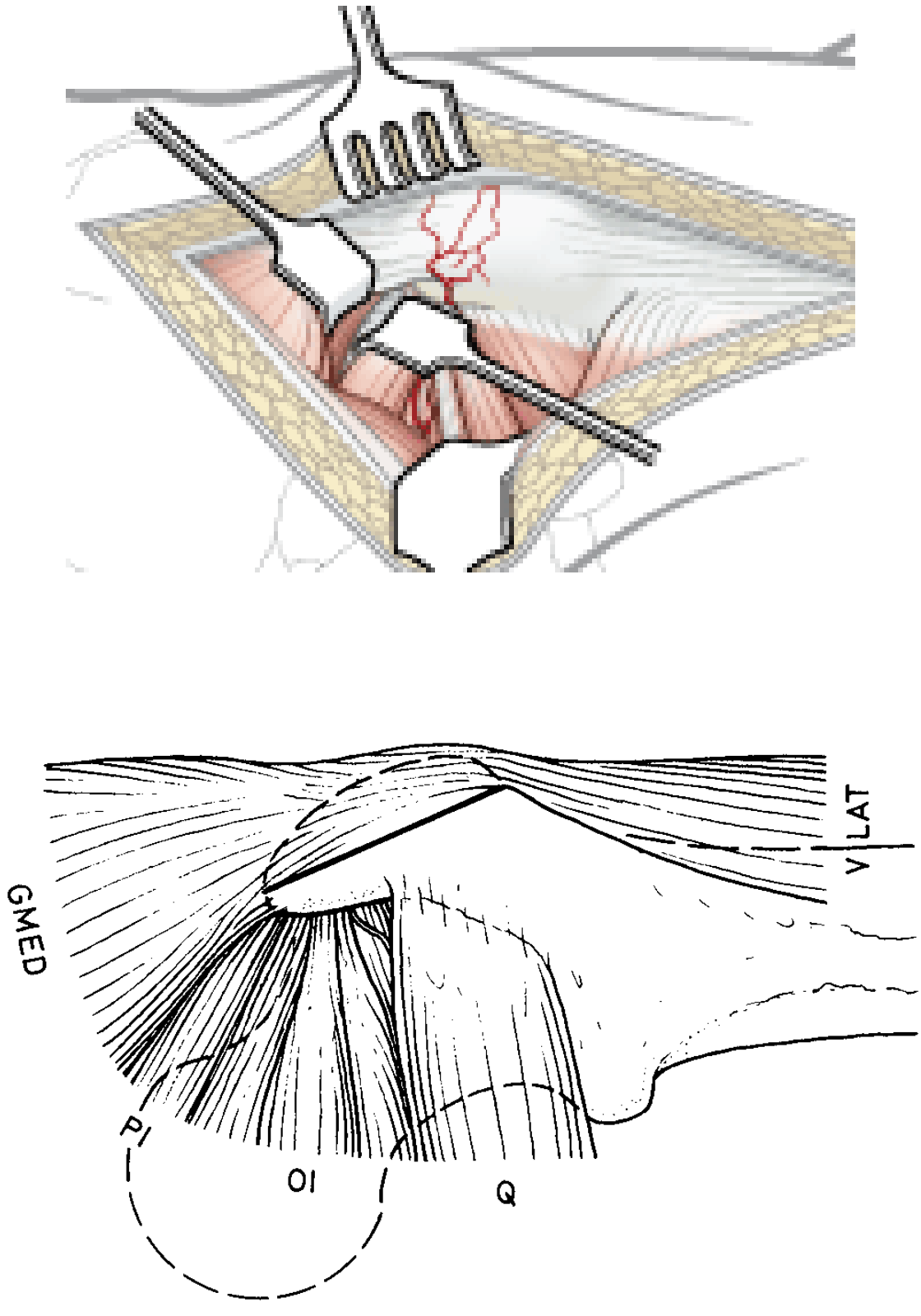
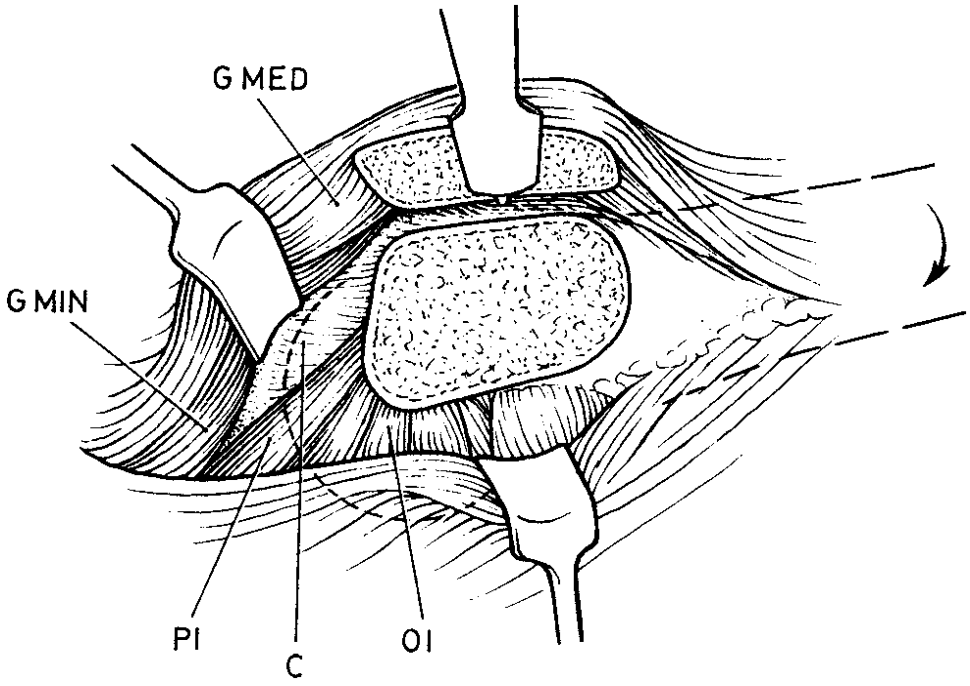


Fig No. 20 Site of Trochanteric Osteotomy

A



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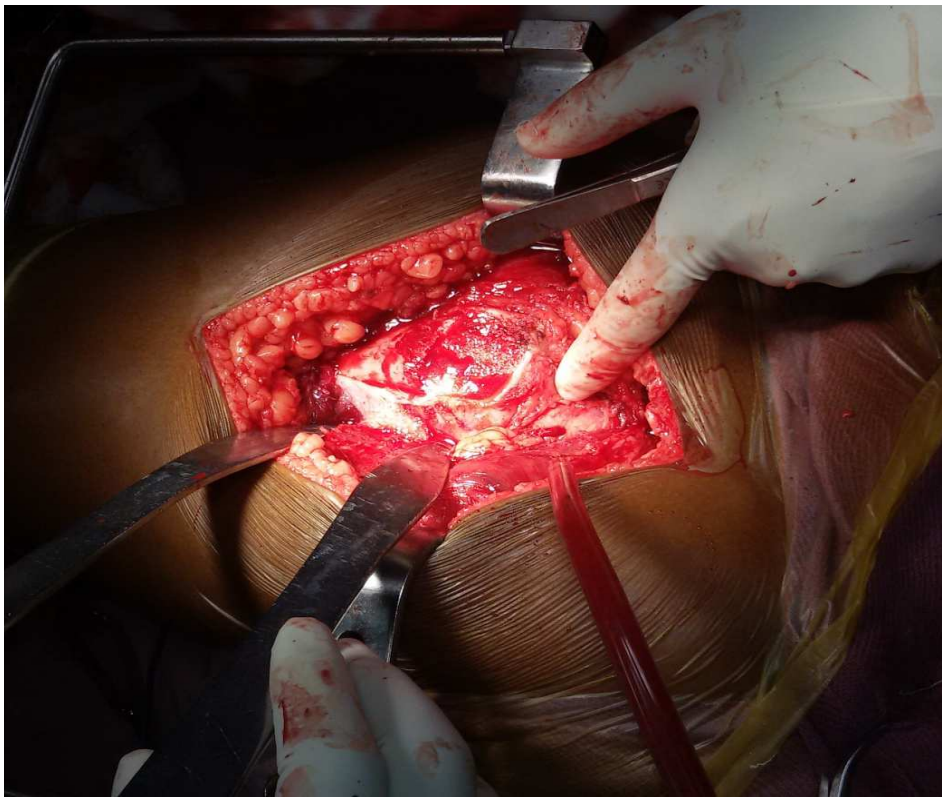
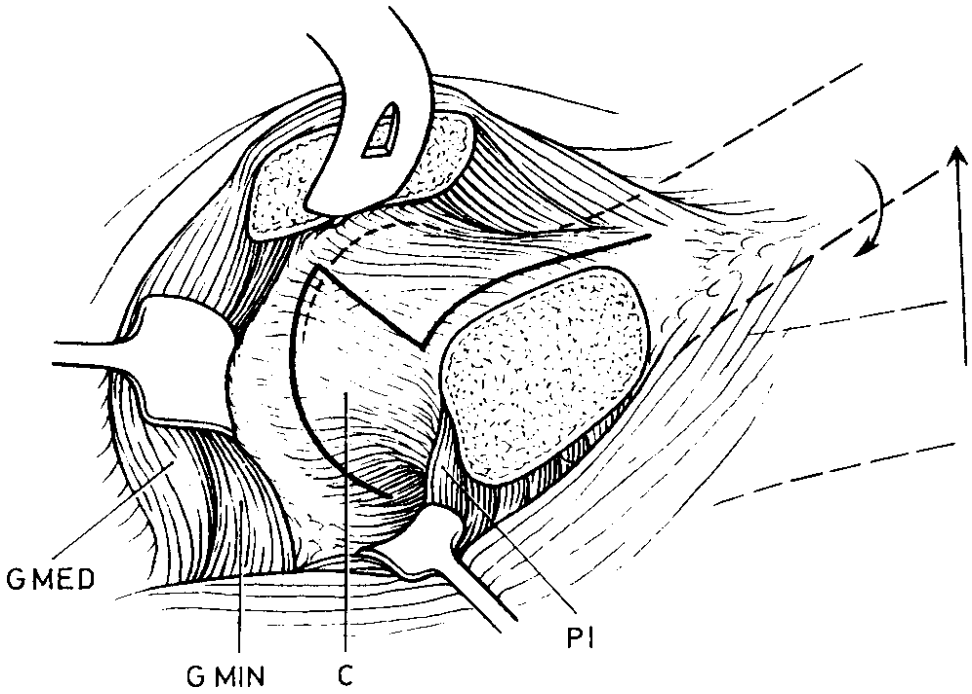


Fig: 21 Trochanteric osteotomy A. Schematic B. Intraop picture

A



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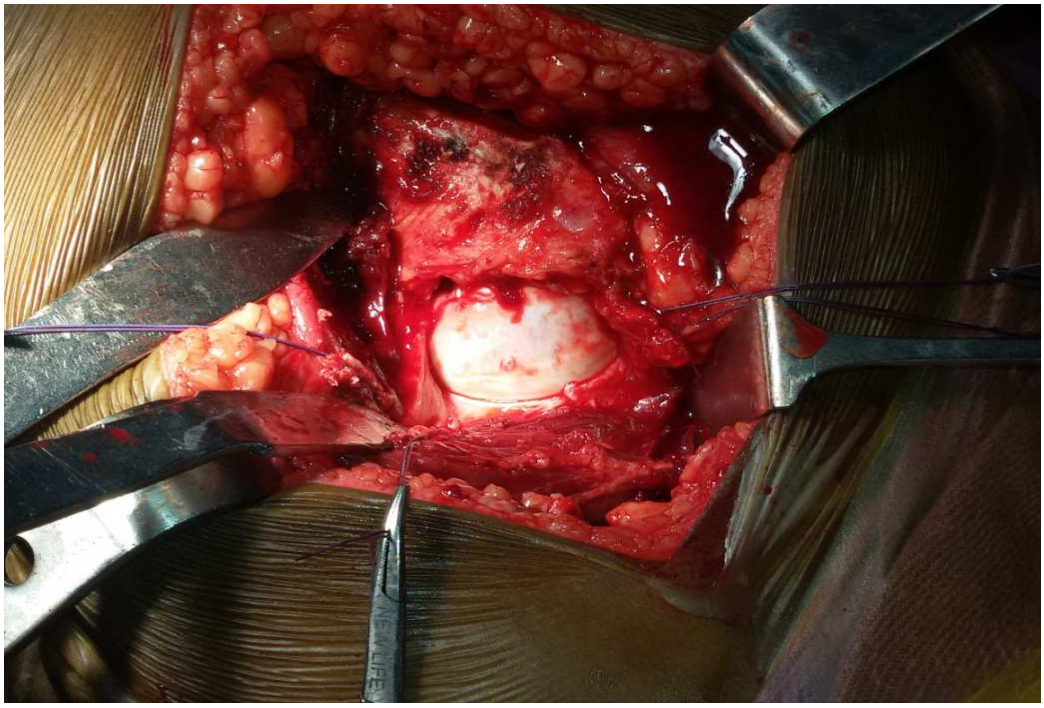
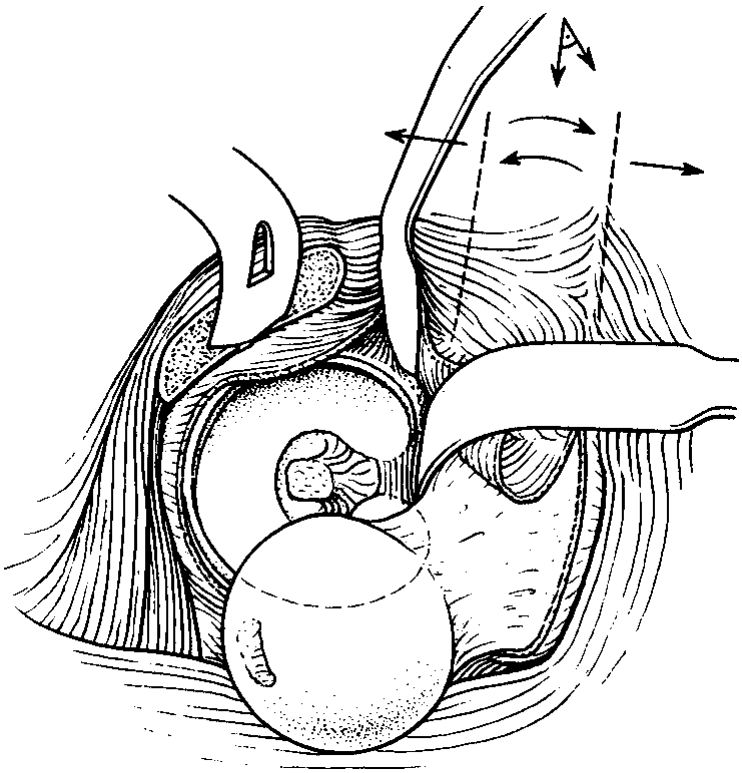


Fig : 22 Anterior Capsulotomy

A



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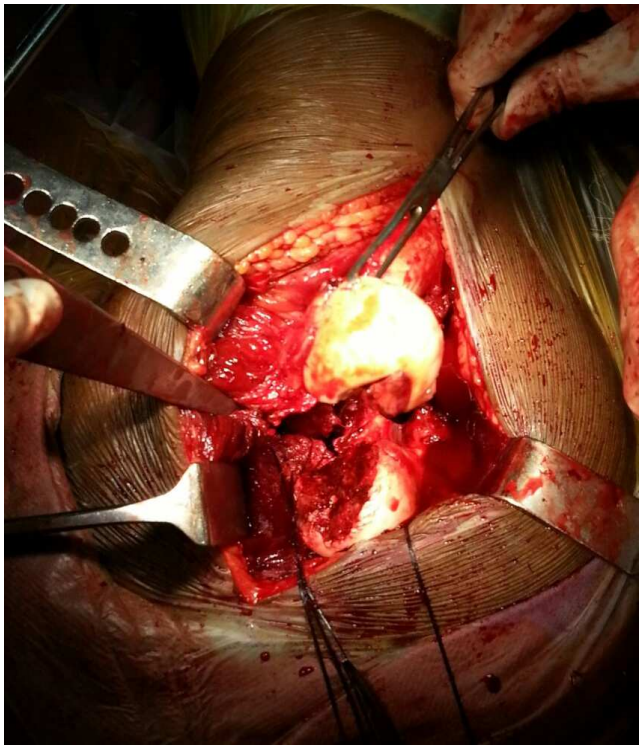


Fig No. 23 Dislocated femur head A. schematic B. Intraop picture

2) Excision of fragment

Through posterior approach we did excision of fragment in one case as the fragment was too small and at attempted fixation the fragment comminuted. It was also on the non weight bearing region so we proceeded with it.

3) Replacement

In three other cases, uncemented total hip replacement was done. Type II patient had the fragments were large with comminution and loss, type III patient had associated injuries which delayed the definitive treatment early and type IV patient had neglected fracture dislocation so we planned for total hip replacement through posterior approach. Type IV patient was treated with acetabular reconstruction in addition to replacement.

Postoperative period

Mobilisation of the patients was started on 2nd day after the surgery. Drain was removed on second day. Post operative intravenous antibiotics(third generation cephalosporin) was given for 5 days. Sutures were removed on 11th postoperative day.

No post operative infection was seen in our study group. Patients were discharged from the hospital after suture removal and safe mobilisation taught by the attending physiotherapist.

For the fixation patients during the first 8 weeks only toe touch weight bearing and passive muscle exercises were allowed. For patients who underwent replacement walking started on the second day with assistance.

Radiographs are taken immediate postoperative , at 8 and 12 weeks as well as 6, 12 and 24 months after surgery.

OBSERVATIONS AND RESULTS

In our institution, 13 patients with hip dislocation and femoral head fractures were admitted and treated during the period of June 2010 and July 2015.

Fractures were classified according to pipkin and brumback classification. There were six pipkin type I, four pipkin type II, two pipkin type III and one pipkin type IV cases.

Closed reduction done in twelve patients at the time of presentation, one patient presented late with neglected pipkin type IV and the attempt unsuccessful.

Treatment options included conservative in one case (pipkin type I), excision of fragment in one case (pipkin type I), open reduction and internal fixation with Herbert screws using a safe surgical dislocation in 8 cases (4 pipkin type I, 3 pipkin type II, 1 pipkin type III) and total hip replacement in three cases (pipkin type II, type III and type IV).

The average age of the patients at the time of the presentation was 36 years (range :19-53years). There were 11 male and 2 female patients (male : female=5.5:1).

Follow-up ranged from 7 to 60 months with an average of 30.08 months. Except for two cases, outcome by the Merle d'Aubigne and Postel score and the HHS was found equal. Eleven out of 13 patients (83.3%) showed good or excellent results in both scores. Two patients had fair outcome as these patient had other associated injuries.

No cases of AVN and surgical site infection was seen. One patient managed with excision of fragment had osteoarthritis (7.69%), two patients had heterotropic ossification of Brooker type I (15.38%) in which one was treated conservatively and one with open reduction and internal fixation.

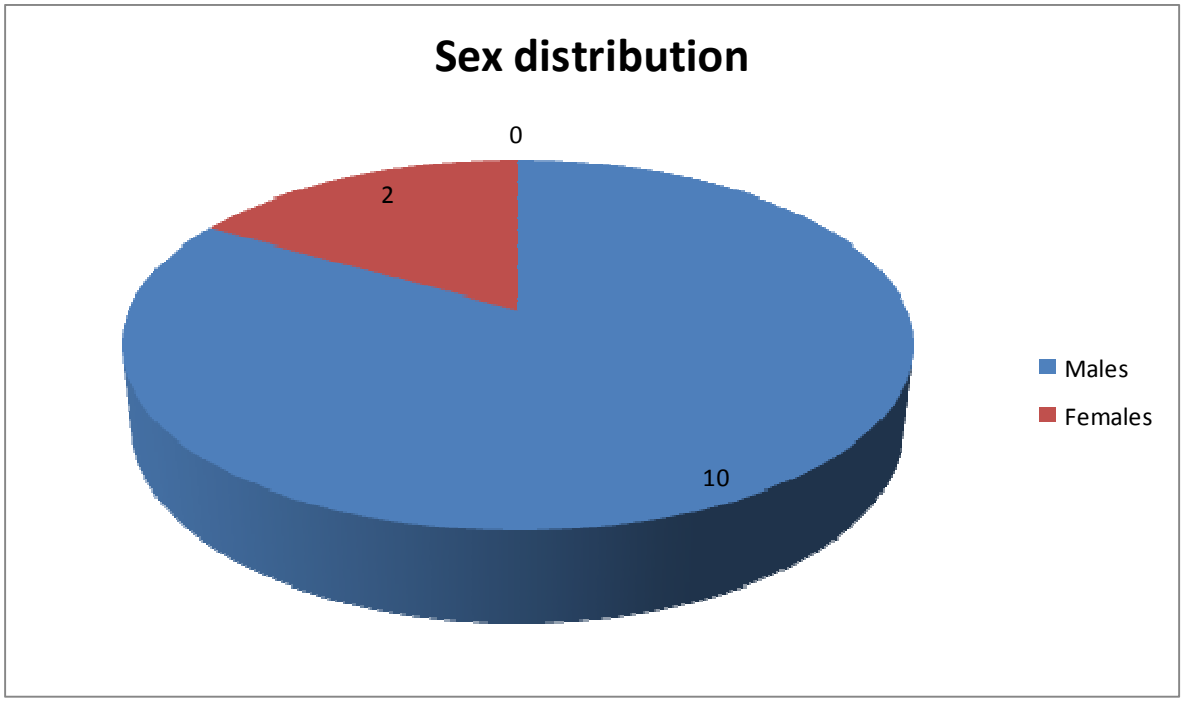


Fig : No- 23 Sex distribution (male : female=5.5:1)

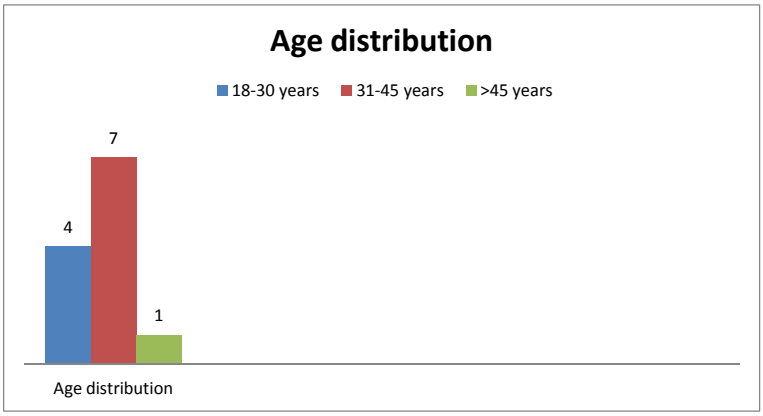


Fig : No- 24 Age Distribution

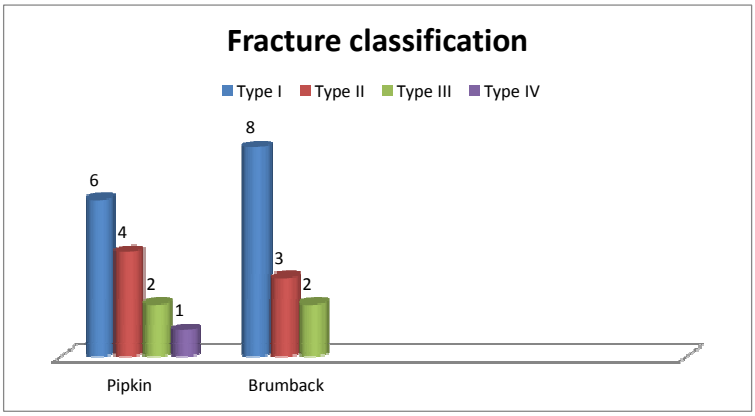


Fig No. 25 Fracture Classification

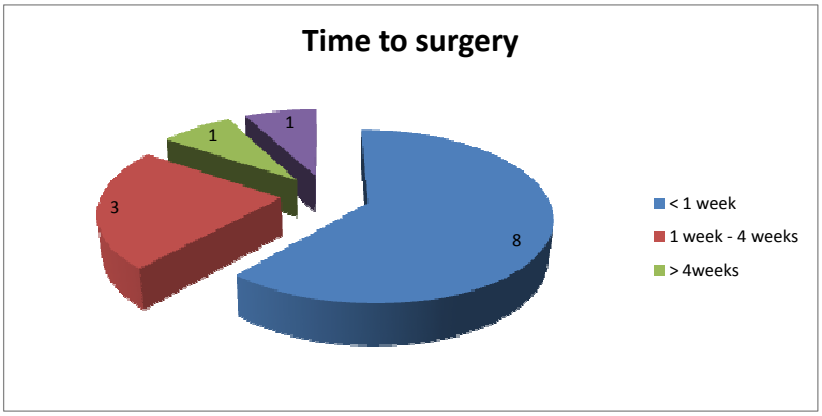


Fig No. 26 Time to Surgery

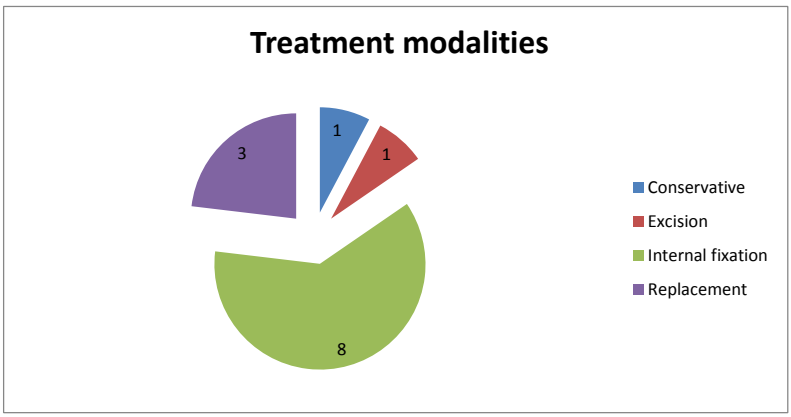


Fig No. 27 Treatment modalities

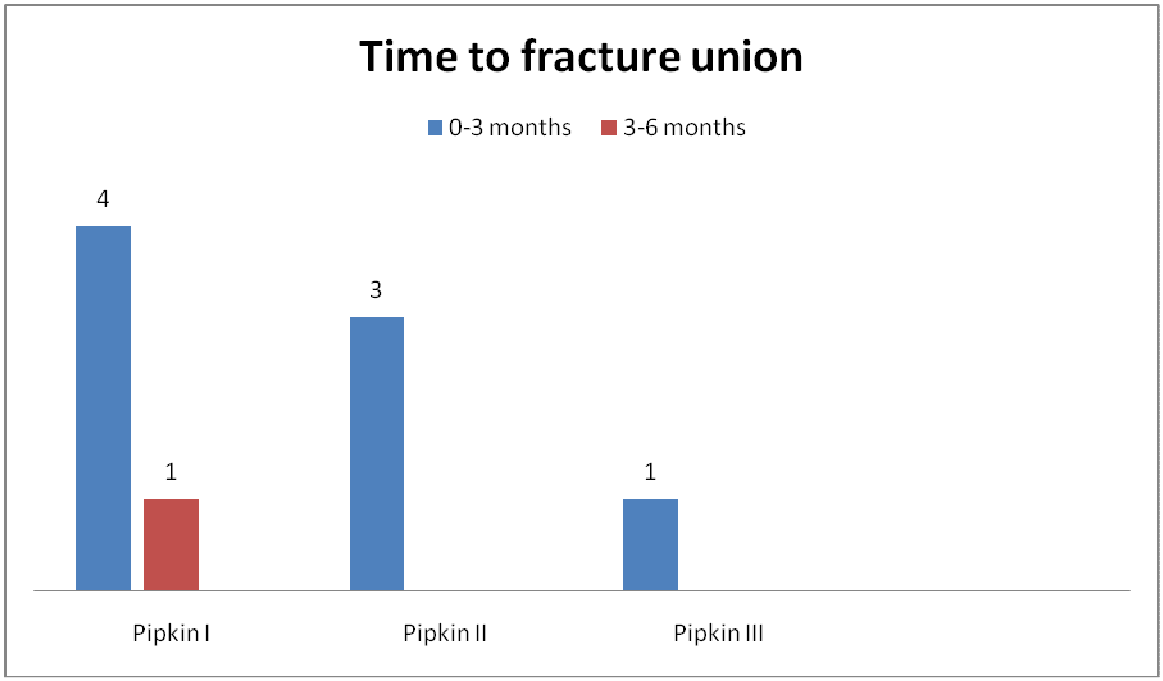


Fig No. 28 Time to fracture union

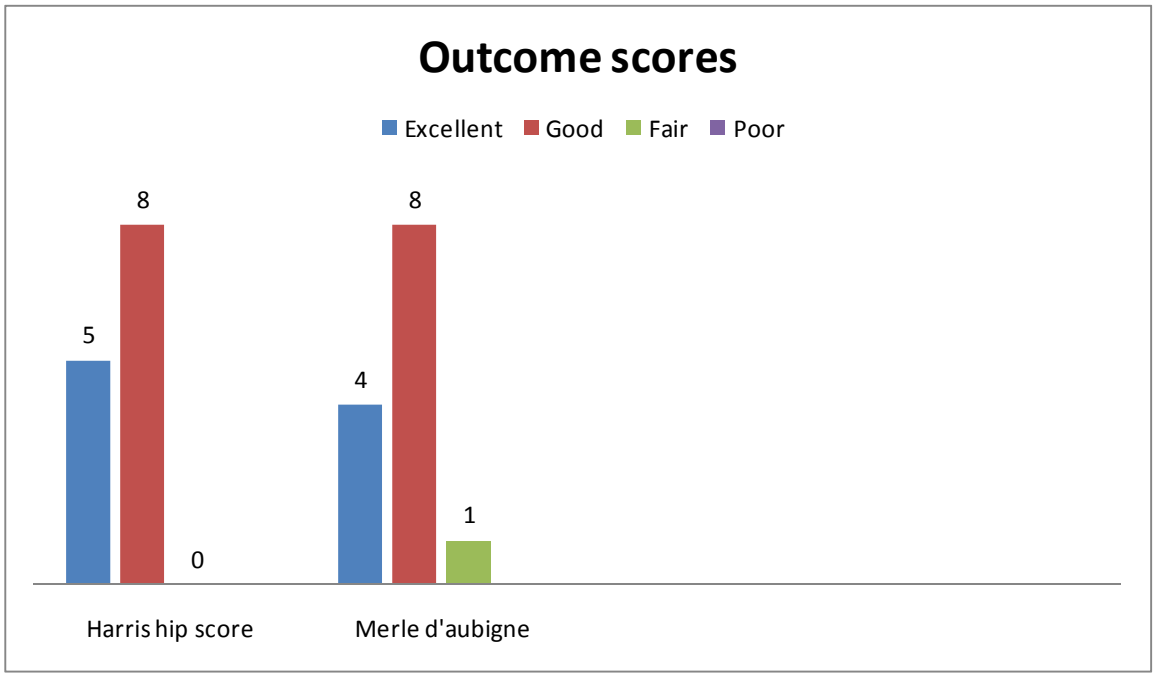


Fig No. 29 Outcome Scores

DISCUSSION

Femoral head fractures are serious injuries. They are usually seen after high-energy trauma following traumatic hip dislocation. Femoral head fracture dislocations are one of the few orthopedic emergencies, and reduction must be done as soon as possible under general anesthesia with good muscle relaxation to prevent further damage.

"Epstein et al[5] suggested that all traumatic dislocations of the hip must be treated as surgical emergencies and reduction within 24 hours gives better results than late reduction and the results after primary open reduction were better than multiple attempts of closed or closed reduction followed by open reduction."

In our series eleven patients reported early and closed reduction done in all cases, with one patient managed conservatively others managed with fixation or excision or replacement. Ten patient's had good to excellent outcomes, one patient with excision had fair outcome.

"McMurtry and Quaile[20] showed that the joint should be relocated within 6 hours; failure to do so increases the risk of avascular necrosis of the femoral head with resultant early degenerative joint disease, often in an otherwise fit, young patient. Some studies suggest that conservative

methods should be considered initially, although treatment of this injury is difficult."

We did closed reduction in eleven patients at the time of presentation, one patient presented late with neglected pipkin type IV and the attempt unsuccessful. No case of avascular necrosis was reported.

"Henle et al[21] showed that only 1 in 12 patients showed an anatomic fracture position after closed reduction; if the fracture gap within the joint showed a displacement of >2 mm, operative treatment was indicated to improve reduction."

We managed one patient was managed conservatively as the displacement of the fracture was < 2mm after closed reduction, other by eleven patients were treated by operative methods.

After reduction, careful examination on thin-cut CT scans was performed for assessing reduction quality, comminution and free intraarticular fragments. The information provided by these radiologic diagnostic modalities allowed a complete understanding of the fracture pattern for the planning of further treatment.

Conservative treatment is accepted only when postreduction CT demonstrates anatomical reduction [21]. Closed conservative treatment can be the best option for only Pipkin type I and type II fractures.

We treated a patient conservatively after the reduction was found anatomically restored and the patient's followup was uneventful and the fracture united after 4 months radiologically.

Fragment excision versus internal fixation

If closed reduction is not appropriate, ORIF should be the choice of treatment. Excision of the fragments is the worst of all. Excision of the fragment was recommended by Epstein in the 1970s, but more recent studies reinforce, maintaining joint congruity as a prerequisite for a good outcome.

According to the literature, excellent and good results in Pipkin type I and type II fractures are achieved in more than 75% after closed treatment, while ORIF yields similar results in 65% of the cases. However, good or excellent results are achieved in only 50% of cases after excision of the fragments.

"Gautier et al[27] showed that the medial femoral circumflex artery, mainly its deep branch, supplies the blood to the femoral head. Recently, a trochanteric-flip osteotomy approach has been recommended for femoral head fractures."

In eight cases of fracture fixation we adopted Ganz safe surgical dislocation and found the vascularity adequate intraoperatively and no AVN was reported during followup.

Over the past decades, excellent or good results of 40-70% have been published in the literature. One of the factors affecting the outcome is surgical exposure. Three surgical approaches are advocated in the literature: anterolateral (Watson-Jones), anterior (Smith-Patterson) and posterior (Kocher-Langenbeck).

Anterior approaches are associated with high rates of heterotopic ossification, but gives an optimal exposure of the fragments of the femoral head. "Swiontkowski et al. compared anterior versus posterior approach in the treatment of Pipkin type I and II fractures. They found that anterior approach caused less blood loss, shorter duration and better visualization but more heterotopic ossification."

“Stockenhuber et al. showed that there is little or no interference with the blood supply of the femoral head via the anterior approach. On the other hand, the posterior approach is associated with additional damage to the posterior circulation, which deteriorated after posterior dislocation and hence increased potential for AVN.”

However, the posterior approach is recommended for Pipkin type IV fractures involving both the posterior wall of the acetabulum and femoral head.

We used posterior approach (Gibson)in all our cases of fixation and did safe surgical dislocation as suggested by Ganz[19], fixation done with Herbert screws and was no case of avascular necrosis was seen. One case was associated with undisplaced femur neck fracture which was fixed with cancellous screw.

We observed two cases of postoperative heterotopic ossification of brooker class I . In our opinion, the experience of the surgeon is the key point for the success of the surgery than the technique itself.

Fixation methods are variable. Some authors advocate 2 mm countersunk titanium minifragment screw. Biodegradable screws have also been used successfully. We used Herbert screws for the fixation in our patients without any problem.

Total hip replacement should be chosen for elderly patients with Pipkin type III fractures. We did total hip replacement in three cases (one each of type I, type III and type IV). In type I patient the head fragment was large comminuted and was not amenable for fixation. Type III patient had associated injuries which delayed the definitive treatment early and was treated later by replacement. Type IV patient presented late with neglected fracture dislocation and was treated by total hip replacement with acetabular reconstruction.

The rate of complications reported include AVN of the femoral head (0-24%), posttraumatic osteoarthritis (0-72%), peripheral nerve damage (7-27%) and heterotopic ossification (2-54%) which affects the long term outcomes [1,21].

In our patient group no case of AVN, one case of posttraumatic arthritis (8.3%), two cases of heterotrophic ossification (16/6%) were seen. AVN and posttraumatic arthritis are serious complications and can be treated with joint replacement.

We found that functional results are not directly related to the treatment modality. The severity of the injury, general health of the patient, timing of the surgery, timing of admission to the hospital, timing of reduction of the hip dislocation, injury at the time of impaction,

cartilage injury, and subchondral collapse are all important factors that affect the outcome in these patients.

Similar to the literatures, our series of femoral head fractures involved different fracture types and different treatment modalities. Since this trauma is rarely seen, the published series are small in number. Therefore, making a statistical analysis or any recommendation is almost impossible. For the same reason, prospective trials regarding outcome and treatment modalities are also not possible.

CONCLUSION

Femoral head fractures have different personalities so complete understanding of the fracture pattern and location is needed when deciding on the optimal treatment for the patient.

Conservative treatment may be indicated in certain situations were the reduction is adequate and stable; but many femoral head fractures need to be treated operatively.

Anatomic reduction of the fragments with minimum soft tissue injury is of prime importance for maintaining vascularity and obtaining good functional results. Associated injuries influence the treatment. Total hip replacement should be chosen for neglected or elderly patients with Pipkin type III fractures.

The Ganz safe surgical dislocation of hip allows 360 degrees visualisation of both femur head and acetabulum and had led to the more anatomic fixation of fracture without compromising vascularity thereby improving the outcome.

In conclusion we found that patients treated by open reduction and internal fixation by safe surgical dislocation had earlier union and better functional outcome with least complications. We believe that newer technologies and techniques will improve the outcome of femoral head fractures.

CASE ILLUSTRATIONS

Case -1

Dr.Sarah 36/F sustained a road traffic accident

Presented with Type I pipkin fracture dislocation

Hip was reduced 3 hrs after injury and the post reduction CT showed good reduction

Managed conservatively

Good functional outcome at 60 months of follow up.

Pre reduction X-ray

8 weeks Post reduction X-ray

60 months followup X-ray

Case 2

Sudhakar 28/M

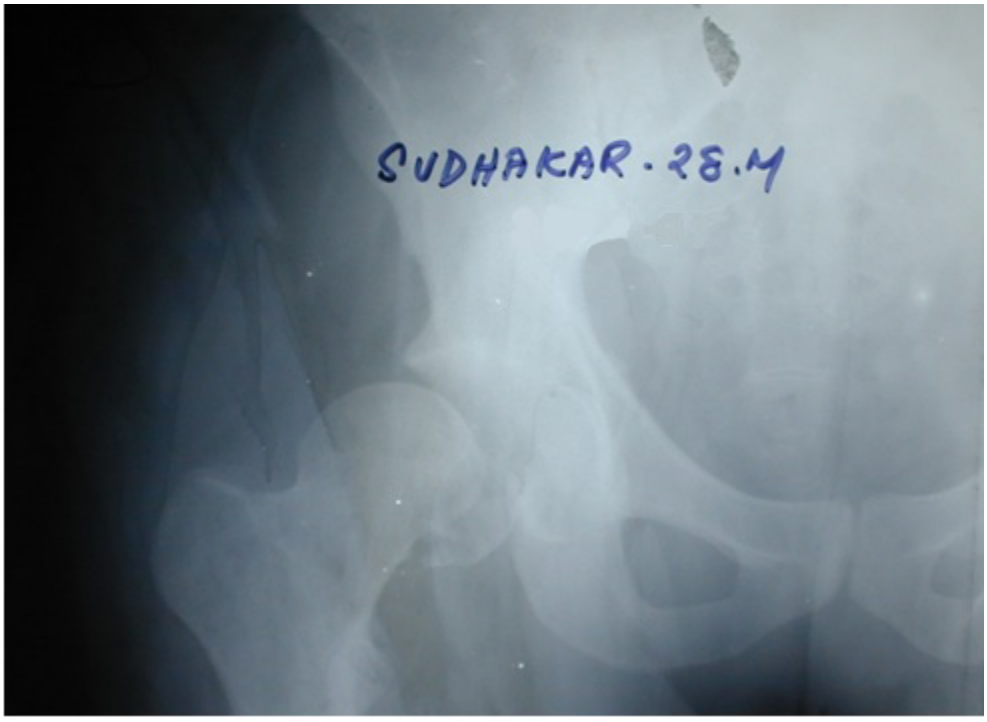
Mr.Sudhakar 28/M sustained a road traffic accident

Presented with Type I pipkin fracture dislocation

Hip was reduced 4 hrs after injury and the post reduction CT showed good reduction

Managed by excision of fragments.

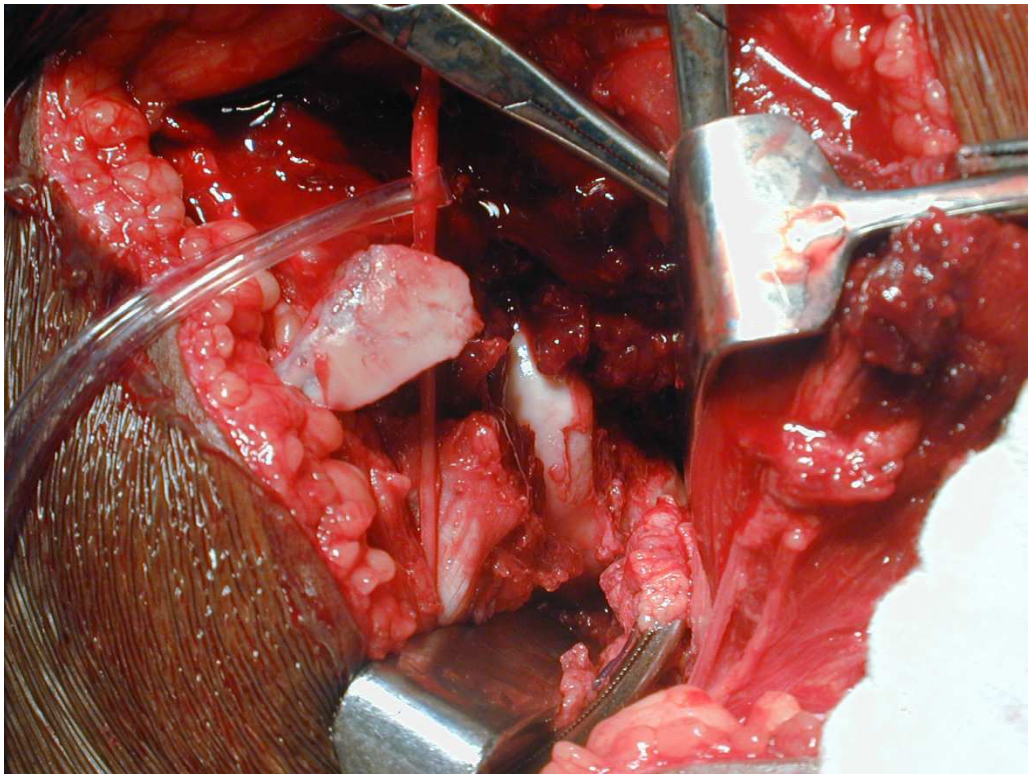
Good functional outcome at 55 months of follow up.



X-ray at presentation

8 weeks post op X-ray

55 months followup X-ray



CLINICAL PICTURE

Case 3

Devaraj 40/M

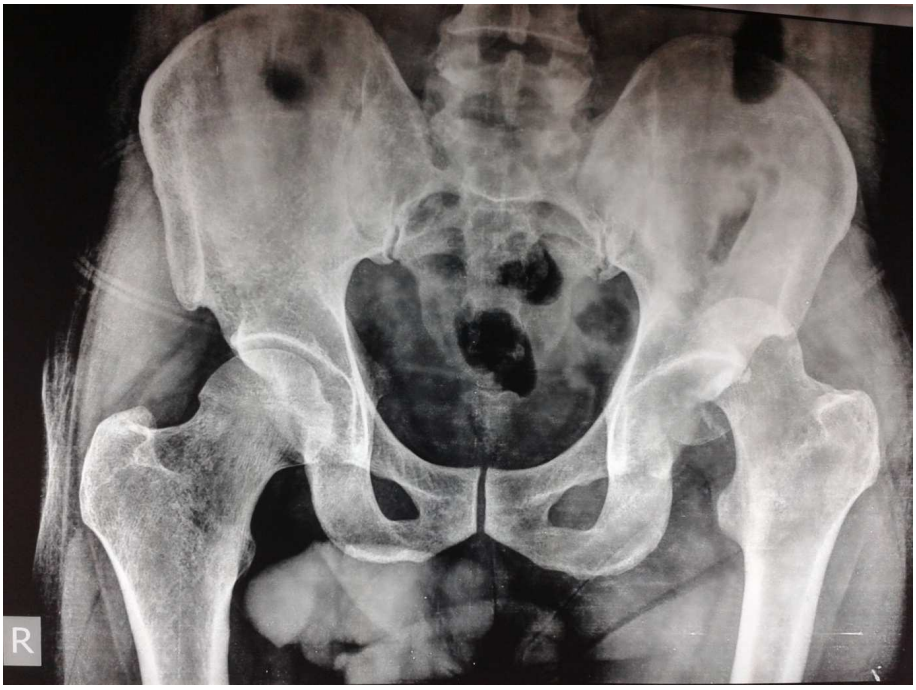
Mr.Devaraj 40/M sustained a road traffic accident

Presented with Type I pipkin fracture dislocation

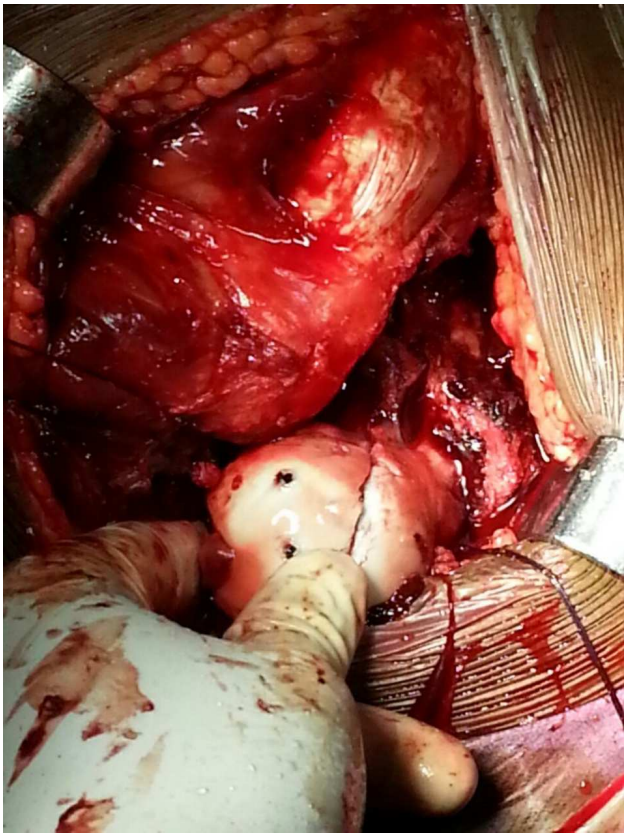
Hip was reduced 6 hrs after injury and the post reduction CT showed good reduction

Managed by ORIF by Ganz Dislocation with Herbert screws.

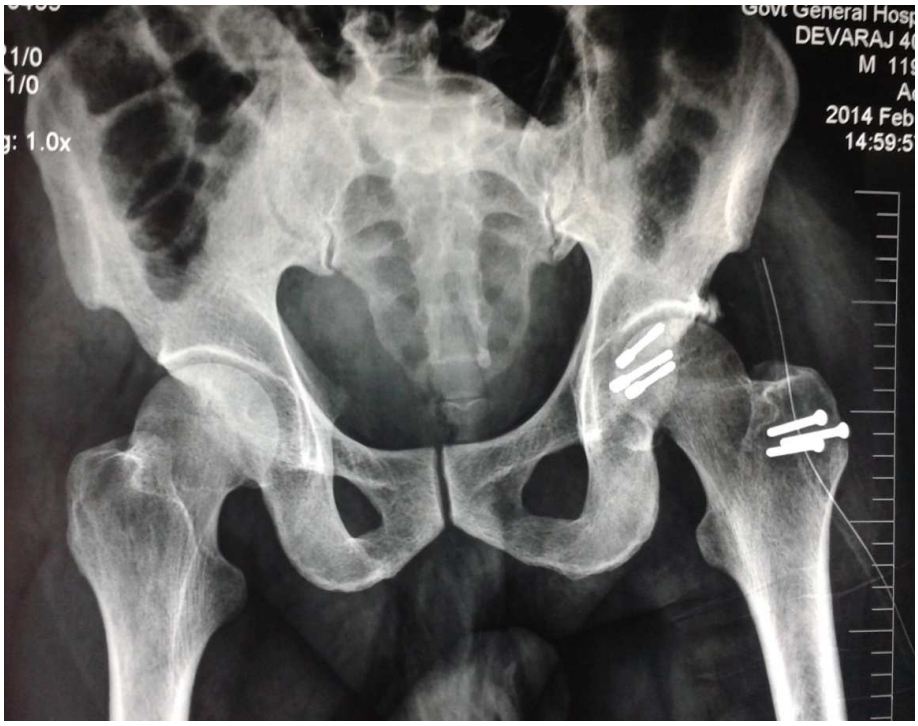
Good functional outcome at 20 months of follow up.



X-ray at presentation



Intra op picture



Post op X-ray

CLINICAL PICTURE

Case 4

Mohanraj 24/M

Sustained a road traffic accident

Grade IIIb compound fracture proximal both bones leg and distal femur with type III pipkin fracture dislocation .

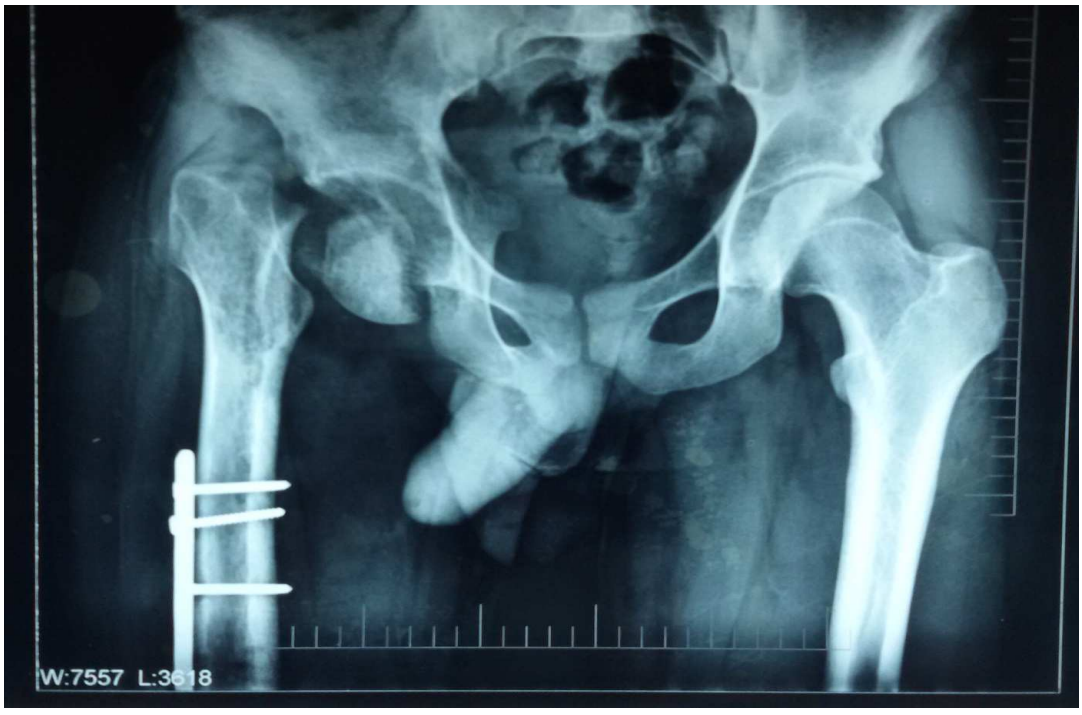
Treated with closed reduction initially and the other injuries delayed the definitive treatment.

Femur and tibia were internally fixed and the extensor mechanism of the knee reconstructed.

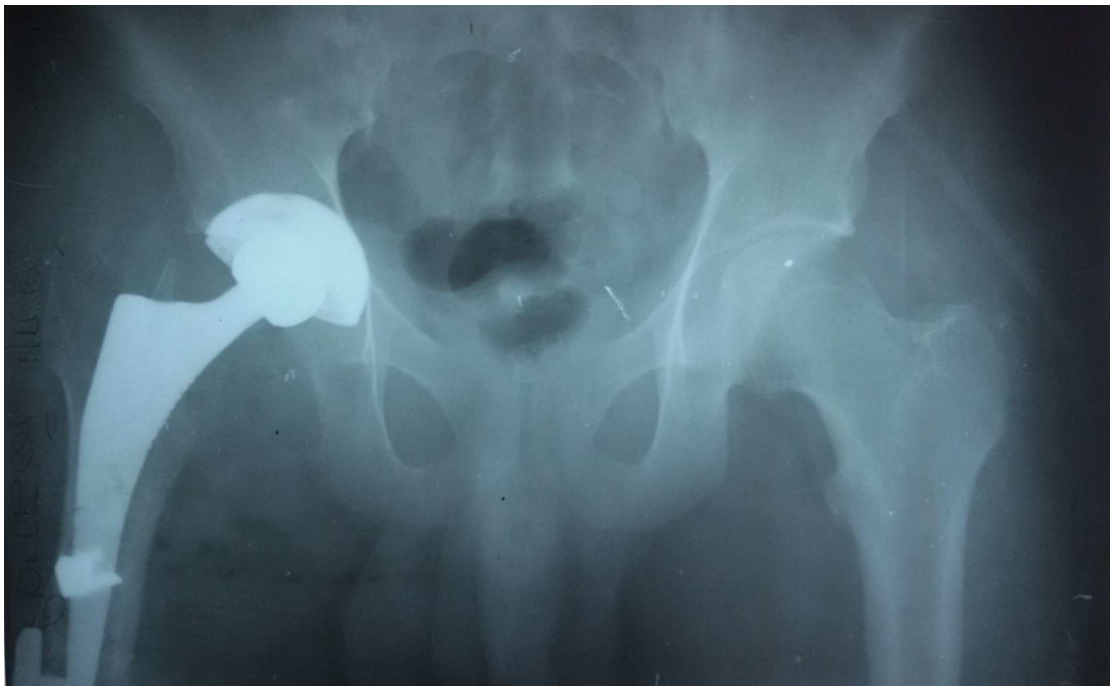
9 months later the patient returned with non-union of neck of femur fracture.

Uncemented total hip replacement done after removing proximal screws from femur locking compression plate.

At the time of presentation



9 months after fixation of femur



Post replacement X-ray

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PROFORMA FOR FEMUR HEAD FRACTURES WITH

POSTERIOR DISLOCATION OF HIP

Name: Age/Sex: IP Number:

Address with contact no.:

Date of admission : Date of surgery:

Diagnosis:

Pipkin Type:

Procedure done :

Approach: Posterior/Posterior with TFO/Others

At presentation

Mode of injury: MVA/MCA/Others(specify) -

Time to reduction of hip:

Outcome: Successful(Congruent/Incongruent) OR Unsuccessful

Associated injuries/procedures:

Comorbity:

Per operative period

Time to surgery:

Bleeding from fragment: Yes/No

Reduction: Satisfactory/comminuted/loss of fragment

Implants used:

Hip Capsule: Reconstruced/Not reconstructed

Post operative period

Date/ time……

Complications:

Wound review:

Check X-Ray result:

Weight-bearing status (please circle): NWB/ PWB/ FWB

* If NWB/ PWB, review in …….weeks

Suture removal on:

Physiotherapy administered:

Date of discharge:

Reviewed by (sign & print name)……

Follow up

1st follow up :

Date/ time……

Complaints:

Complications: Heterotropic ossification/AVN/Arthritis/Others(specify)

Wound review:

Check X-Ray result:

Other investigations(if any):

Weight-bearing status (please circle): NWB/ PWB/ FWB

* If NWB/ PWB, review in …….weeks

Merle d’ Aubigne and Postel Score:

Harrris Hip Score:

Reviewed by (sign & print name)……

2nd follow up:

Date/ time……

Complaints:

Complications: Heterotropic ossification/AVN/Arthritis/Others(specify)

Findings:

Check X-Ray result:

Other investigations(if any):

Merle d’ Aubigne and Postel Score:

Harrris Hip Score:

Reviewed by (sign & print name)……

CONSENT FORM

Name of the patient;_____ Date:_____

S/W/D Of:_____

Theses No:_____Address:_____

_____.

Phone No:

1. I,_____ S/W/D Of:_____ , resident of _____
   Have been informed by the doctor that the clinical diagnosis of my disease is _____
2. I have been further informed by the doctor that the treatment planned for my disease is_____.
3. I have been given the options to ask for any second opinion regarding the diagnosis and treatment.
4. I have been informed that after surgery, I will not be able to squat on the ground and sit cross legged.
5. The risks of the surgery have been discussed with me in the language I understand. The major risks which have been discussed include :
   A: Infection
   B: Deep Vein Thrombosis and Pulmonary Embolism
   C:Anaesthetic Risks
6. I have been given the opportunity to ask all questions and I have been satisfactorily answered
7. I am aware that in the practice of medicine , other untoward/unexpected risks or complications not discussed may occur. I further understand that during the course of the proposed surgical procedure , unforeseen conditions may be revealed necessitating the performance of additional rectifying /modifying surgery.
8. The translation of the above has been made explained to me in the language I best understand

Date of surgery: Signature Of The Patient/Authorizing Person (With Relation)

Witness 1:

Witness 2:

MODIFIED HARRIS HIP SCORE

Pain:

___None/ignores (44points)

___Slight, occasional, no compromise in activity (40 points)

___Mild, no effect on ordinary activity, pain after activity, uses aspirin (30 points)

___Moderate, tolerable, makes concessions, occasional codeine (20 points)

___Marked, serious limitations (10 points)

___Totally disabled (0 points)

Function: Gait

Limp

___None (11 points)

___Slight (8 points)

___Moderate (5 points)

___Severe (0 points)

___Unable to walk (0 points)

Support

___None (11 points)

___Cane, long walks (7 points)

___Cane, full time (5 points)

___Crutch (4 points)

___2 canes (2 points)

___2 crutches (1 points)

___Unable to walk (0 points)

Distance Walked

___Unlimited (11 points)

___6 blocks (8 points)

___2-3 blocks (5 points)

___Indoors only (2 points)

___Bed and chair (0 points)

Functional Activities:

Stairs

___Normally (4 points)

___Normally with banister (2 points)

___Any method (1 points)

___Not able (0 points)

Socks/Shoes

___With ease (4 points)

___With difficulty (2 points)

___Unable (0 points)

Sitting

___Any chair, 1 hour (5 points)

___High chair, ½ hour (3 points)

___Unable to sit, ½ hour, any chair (0 points)

Public Transportation

___Able to enter public transportation (1 points)

___Unable to use public transportation (0 points)

>90 =Excellent

80-89=Good

70-79=Fair

<70 =Poor

MODIFIED MERLE D' AUBIGNE AND POSTEL SCORE

Pain subscale

6 = No pain

5 = Slight or intermittent

4 = Pain after ambulation, resolves with rest

3 = Moderately severe, permits ambulation

2 = Severe, prevents ambulation

Ambulation subscale

6 = Normal

5 = Slight limp, no cane

4 = Long distance with cane or crutch

3 = Limited even with support

2 = Very limited

1 = Nonambulatory

Range of motion subscale	*Right*	*Left*
Flexion-extension	_____	_____
Abduction	_____	_____
Adduction	_____	_____
Internal rotation (prone)	_____	_____
External rotation (prone)	_____	_____
Total ROM	_____	_____

Percent of range of motion = (Total ROM Injured/Total ROM Normal) × 100

6 = 95–100%

5 = 80–95%

4 = 70–80%

3 = 60–70%

2 = 50–60%

1 = <50%

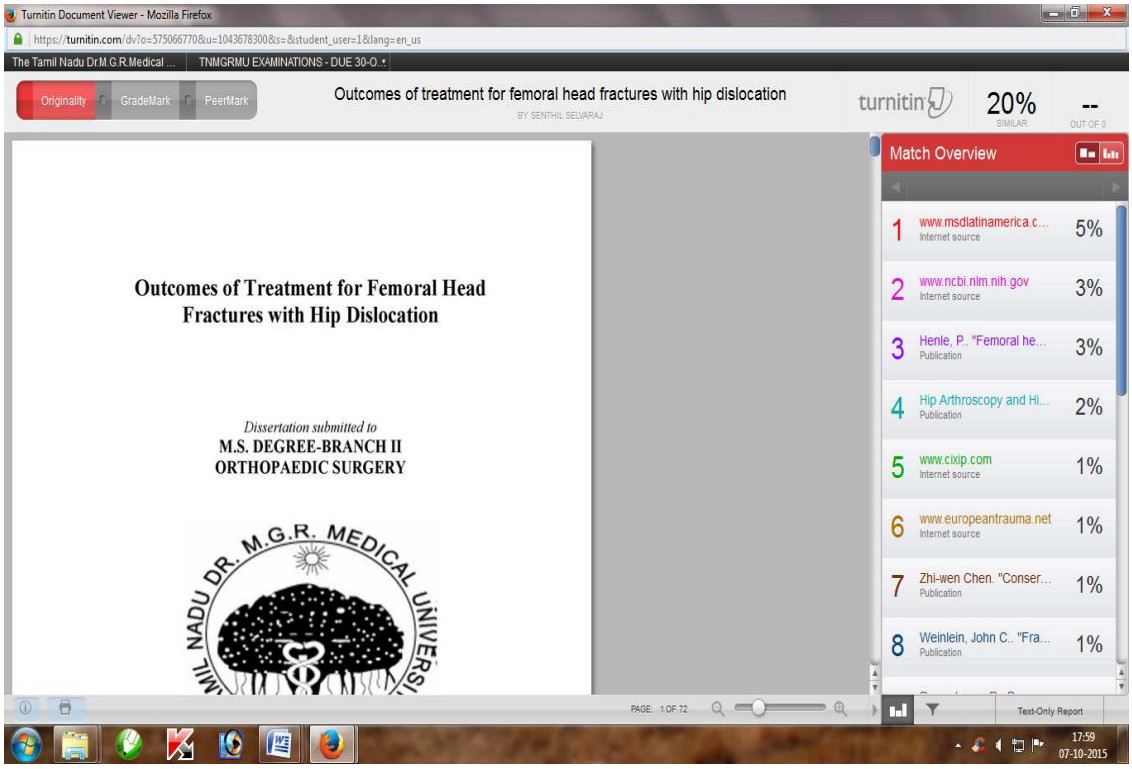
Clinical grade = total points (pain + ambulation + ROM)

18 = Excellent

15–17 = Good

13–14 = Fair

<13 = Poor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ORTHOPAEDIC SURGERY
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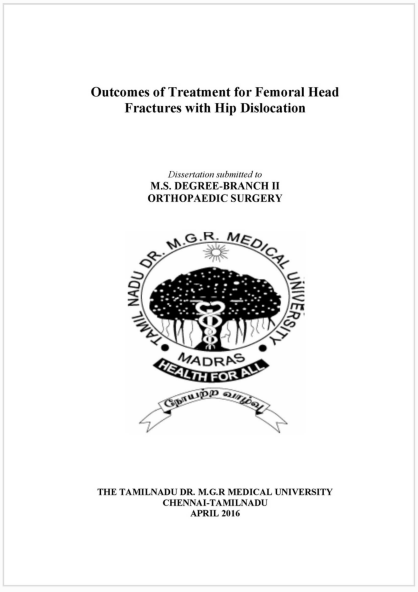

Outcomes of Treatment for Femoral Head Fractures with Hip Dislocation

Dissertation submitted to
M.S. DEGREE-BRANCH II
ORTHOPAEDIC SURGERY

THE TAMILNADU DR. M.G.R MEDICAL UNIVERSITY
CHENNAI-TAMILNADU
APRIL 2016

DEMOGRAPHIC DATA AND OUTCOMES OF TREATMENT OF THE PATIENTS WITH FEMORAL HEAD FRACTURES

S. No	Age / Sex	Pipkin type	Brumback type	Time to surgery	Concurrent conditions	Treatment	Follow up (Months)	Time to # union (months)	HHS	Merle d'Aub	Results	Complications
1	36/F	I	1A	Nil	Nil	Closed reduction & Conservative	60	4	96	16	Good	HO (Brooker I)
2	25/M	III	3B	3 days	Femur neck fracture	ORIF by Ganz dislocation and Cancellous screw fixation	55	2	95	17	Excellent	Nil
3	19/M	II	2A	3 days	Nil	ORIF by Ganz dislocation	55	1.5	94	16	Good	Nil
4	28/M	I	1B	5 days	Nil	Excision of fragment	55	Nil	94	15	Good	OA
5	34/M	I	1A	15 days	Pubic diastasis with sacroiliac joint disruption with ARDS	ORIF by Ganz dislocation	30	2	85	12	Fair	Nil
6	33/F	IV	1A	14days	Acetabular fracture	THR with acetabular reconstruction	22	Nil	90	16	Good	Nil
7	40/M	I	1A	5days	Nil	ORIF by Ganz dislocation	20	2	94	16	Good	Nil
8	53/M	II	2A	12days	Nil	THR	19	Nil	96	17	Excellent	Nil
9	28/M	II	2A	7days	Fracture of Both bones leg & forearm	ORIF by Ganz dislocation	18	1.5	94	13	Good	Nil
10	24/M	III	3B	9months	Ipsilateral compound distal femur and proximal tibia	THR with Internal fixation for femur and tibia patellectomy with extensor mechanism repair	16	Nil	90	12	Good	Nil
11	23/M	II	1A	2 days	Nil	ORIF by Ganz dislocation	12	2	95	17	Excellent	NIl
12	24/M	I	1A	7 days	Ilium fracture	ORIF by Ganz dislocation	8	1.5	95	17	Excellent	HO (Brooker I)
13	36/M	I	1A	14days	Ipsilateral shaft of femur and humerus fracture	ORIF by Ganz dislocation	7	2	92	14	Good	Nil